# FLOODS IN WEST VIRGINIA, VIRGINIA, PENNSYLVANIA, AND MARYLAND, NOVEMBER 1985

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U.S. GEOLOGICAL SURVEY
Water-Resources Investigations Report 88-4213

U.S. DEPARTMENT OF THE INTERIOR
March 3, 1849

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**By D.H. Carpenter**

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Towson, Maryland

1990

U.S. DEPARTMENT OF THE INTERIOR

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## FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM OF METRIC UNITS (SI)

For those readers who may prefer to use metric (International System) units rather than the inch-pound units used in this report, the following conversion factors may be used:

| Multiply inch-pound unit | By | To obtain metric unit |
|---|---|---|
| | **Length** | |
| inch (in.) | 25.4 | millimeter (mm) |
| foot (ft) | 0.3048 | meter (m) |
| mile (mi) | 1.609 | kilometer (km) |
| | **Area** | |
| square foot ($ft^2$) | 0.09294 | square meter ($m^2$) |
| square mile ($mi^2$) | 2.590 | square kilometer ($km^2$) |
| | **Velocity** | |
| foot per second (ft/s) | 0.3048 | meter per second (m/s) |
| | **Volume** | |
| million gallons (Mgal) | 3,785 | cubic meters ($m^3$) |
| | **Flow** | |
| cubic foot per second ($ft^3/s$) | 0.02832 | cubic meter per second ($m^3/s$) |
| cubic foot per second per square mile [$(ft^3/s)/mi^2$] | 0.01093 | cubic meter per second per square kilometer [$(m^3/s)/km^2$] |

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# FLOODS IN WEST VIRGINIA, VIRGINIA,

# PENNSYLVANIA, AND MARYLAND,

# NOVEMBER 1985

By D. H. Carpenter

## ABSTRACT

Heavy rainfall during the period October 31-November 6, 1985, caused record-breaking floods over a large region covering eastern West Virginia, western and northern Virginia, southwestern Pennsylvania, and western Maryland. The rainfall, most of which fell on November 4 and 5 and was indirectly related to Hurricane Juan, exceeded 10 inches over large areas. A maximum of 19.77 inches was recorded at the U.S. National Weather Service gage, Montebello 2 NE, in the Blue Ridge Mountains in Virginia.

Record-breaking flood discharges occurred at many locations within the Potomac, James, Roanoke, Monongahela, and Kanawha River basins. Flood-peak data were obtained at 190 sites within the affected area. New maximum peak discharges were recorded at 63 streamflow gaging stations; peaks exceeded 100-year recurrence intervals at 63 sites. The new record peaks exceeded the previous maximum recorded discharges by more than 50 percent at 40 of the gaging stations and were, on the average, 89 percent greater than the previous maximums.

A total of 62 lives were lost because of the flooding in the four-State region, and storm damage was estimated to be $1,400 million. Damage to the Roanoke-Salem, Virginia, area alone was estimated to be $440 million. Several small towns in West Virginia were almost totally destroyed. The U.S. Army Corps of Engineers reported that the operation of flood-control projects in several river basins, including North Branch Potomac, James, Tygart Valley, and Kanawha, reduced total damage substantially.

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Manuscript approved for publication November 29, 1988.

# INTRODUCTION

Multiple storms during the period from October 31 through November 6, 1985, caused extremely destructive flooding over large areas of West Virginia and Virginia. Pennsylvania and Maryland also experienced severe, but more localized, flooding.

The flood in West Virginia was the worst in the State's history. It has been nicknamed the "Killer Flood of 1985" in that State. In Virginia, because of the extraordinary fury of earlier Hurricanes Camille (1969) and Agnes (1972), it is a matter of conjecture as to whether this storm was the most devastating. Although Maryland and Pennsylvania experienced some severe, localized flooding in their western regions from this storm, they were spared widespread devastation. Photographs (figs. 1-3) provide some insight into the overall effect of the flood.

As much as 19 in. of rain fell over the affected region during the 7-day multiple-storm period. Virtually all the precipitation was related either directly or indirectly to an otherwise unimpressive hurricane named "Juan." The maximum rainfall recorded (at an official U.S. National Weather Service gage) was 19.77 in. at Montebello 2 NE, in the Blue Ridge Mountains of Virginia. More than 10 in. of rainfall (official) was recorded over a fairly widespread area in north-central Virginia and eastern West Virginia.

Record-breaking floods occurred on many streams (including the main-stem rivers) in the Potomac, James, Roanoke, Monongahela, and Kanawha River basins. Many communities in West Virginia, such as Albright and Parsons along the Cheat River, and Petersburg along the South Branch Potomac River, were nearly destroyed. In Virginia, the cities of Roanoke and Lynchburg, along the Roanoke and James Rivers, respectively, experienced extremely severe damage. In the four-State affected area, 62 people lost their lives and property damage was estimated to be $1,400 million.

Flood-discharge data were recorded at 190 streamflow-gaging stations operated in the affected area. The locations of the gaging stations, the pattern of which virtually delineates the affected area, are shown in figure 4. Peak stage and discharge figures are presented in this report for the 190 gaging stations. Recurrence-interval data and discharge hydrographs for selected sites also are included.

This report is an outgrowth of U.S. Geological Survey Open-File Report 86-486, "Flood of November 1985 in West Virginia, Pennsylvania, Maryland, and Virginia," by Joseph B. Lescinsky. The original report presented only basic information to allow for its early release to the public. This report provides more detailed coverage of the flooding and damage with more complete confirmation of the data presented.

Figure 1.-- The aftermath. (Photograph by Aubrey Wiley, The News and Daily Advance, Lynchburg, Va.)

Figure 2.-- Tree on Cheat River bridge, State Highway 22, Albright, W. Va. (Photograph by Dale Sparks, Dominion Post, Morgantown, W. Va.)

Figure 3.-- Cattle on temporary island, James River, Va. (Photograph by Dan Doughtie, Roanoke Times and World News.)

## Purpose and Scope

The purpose of this report is to document the significant rainfall and streamflow data, along with general damage information including costs and fatalities, related to the flood of November 1985. The data provide a technical basis on which to make flood-plain management decisions.

The report documents the flooding over a region covering eastern West Virginia, western and northern Virginia, southwestern Pennsylvania, and western Maryland. Flood data are evaluated for 190 streamflow-gaging stations within the flood-affected region. A description of the storm-related rainfall is provided in the report along with a map of its distribution (see fig. 5).

## Acknowledgments

Precipitation data were provided by the National Weather Service of the National Oceanic and Atmospheric Administration (NOAA). Data from the Virginia State-operated streamflow-gaging network were compiled by the Charlottesville office of the Virginia Water Control Board. Flood data including peak stages and discharges, recurrence intervals, and hydrograph data were compiled by U.S. Geological Survey personnel as part of the cooperative programs with West Virginia, Virginia, Pennsylvania, and Maryland. The isohyetal map of the storm period was derived from a computer-generated map provided by Robert B. Jacobson, geomorphologist with the Geologic Division, U.S. Geological Survey. Thanks are given to the newspapers and individuals who provided photographs used in the report.

# DESCRIPTION OF STORM

The flooding of November 1985 in the four-State area of West Virginia, Virginia, Pennsylvania, and Maryland resulted from a rather complex sequence of meteorological events (Virginia State Climatology Office, 1986). Three separate but related low-pressure systems contributed to the problem.

The first event, which only set the stage for the record flood, received the most public notice. This event was Hurricane Juan and the publicity resulted because its associated windspeed gave it hurricane status, though barely. Hurricane Juan came ashore from the Gulf of Mexico over southern Mississippi and followed a generally northerly path until its remnants ultimately reached Michigan.

During its northern passage, Juan spawned a small secondary low-pressure system which moved eastward across North Carolina and passed offshore. This system, together with Juan, produced primarily moderate rainfall in the study area.

A third low-pressure system, which also was an outgrowth of the influence of Juan on the atmosphere, then transformed what would have been a very minor flood event into a major disaster.

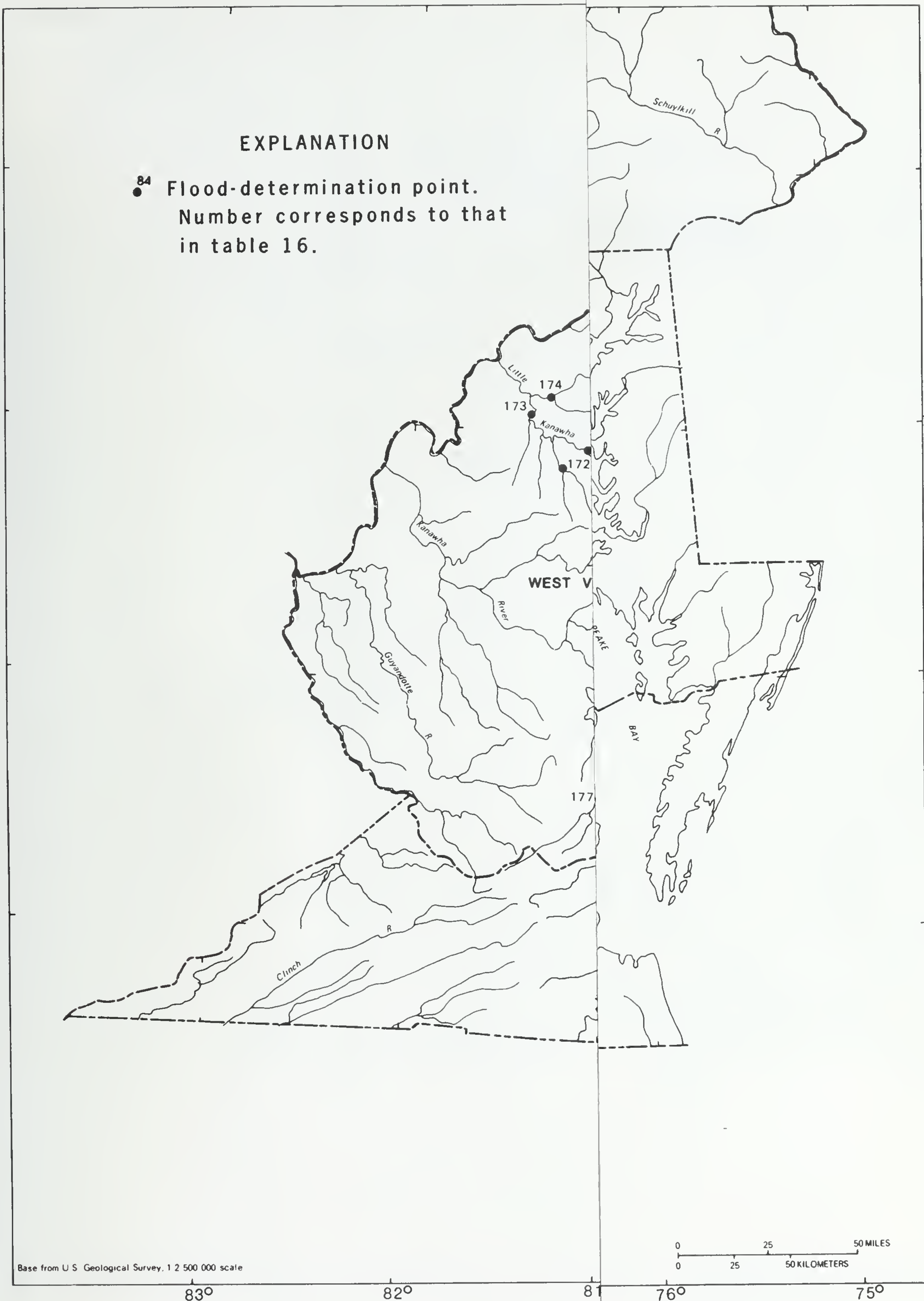



**Figure 4.-- Location of streamflow-gaging stations in flo**

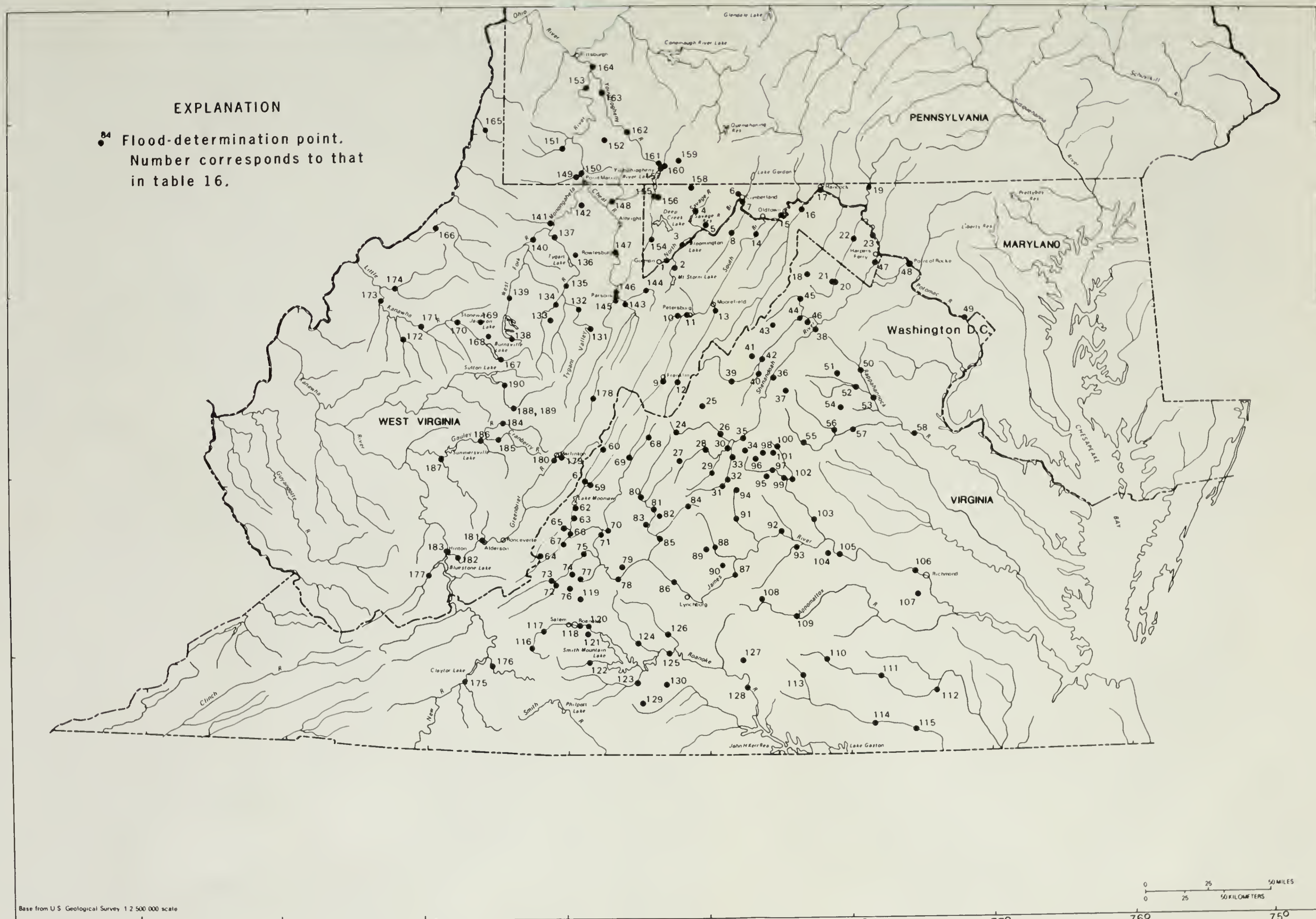



**Figure 4.-- Location of streamflow-gaging stations in flood area.**

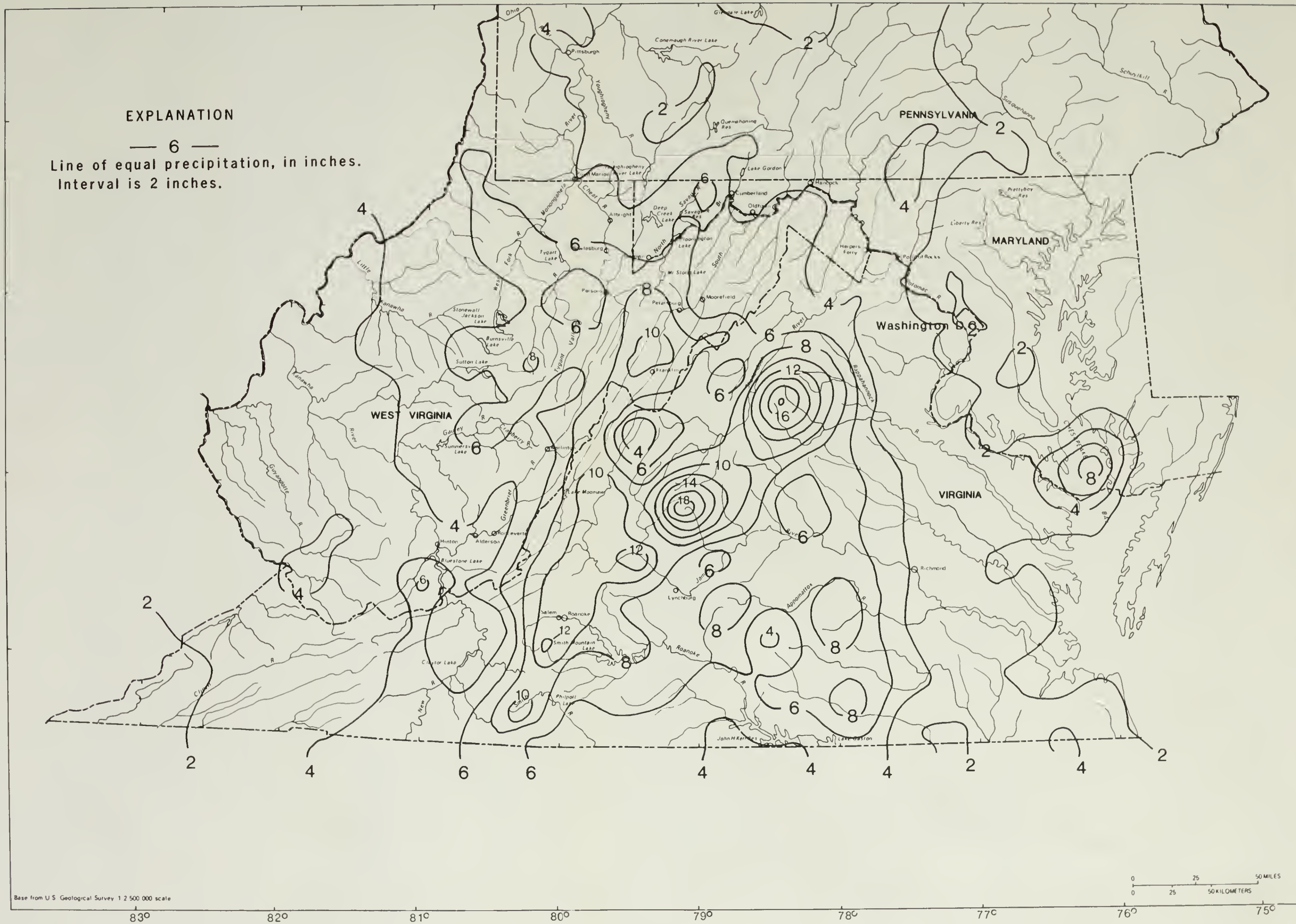
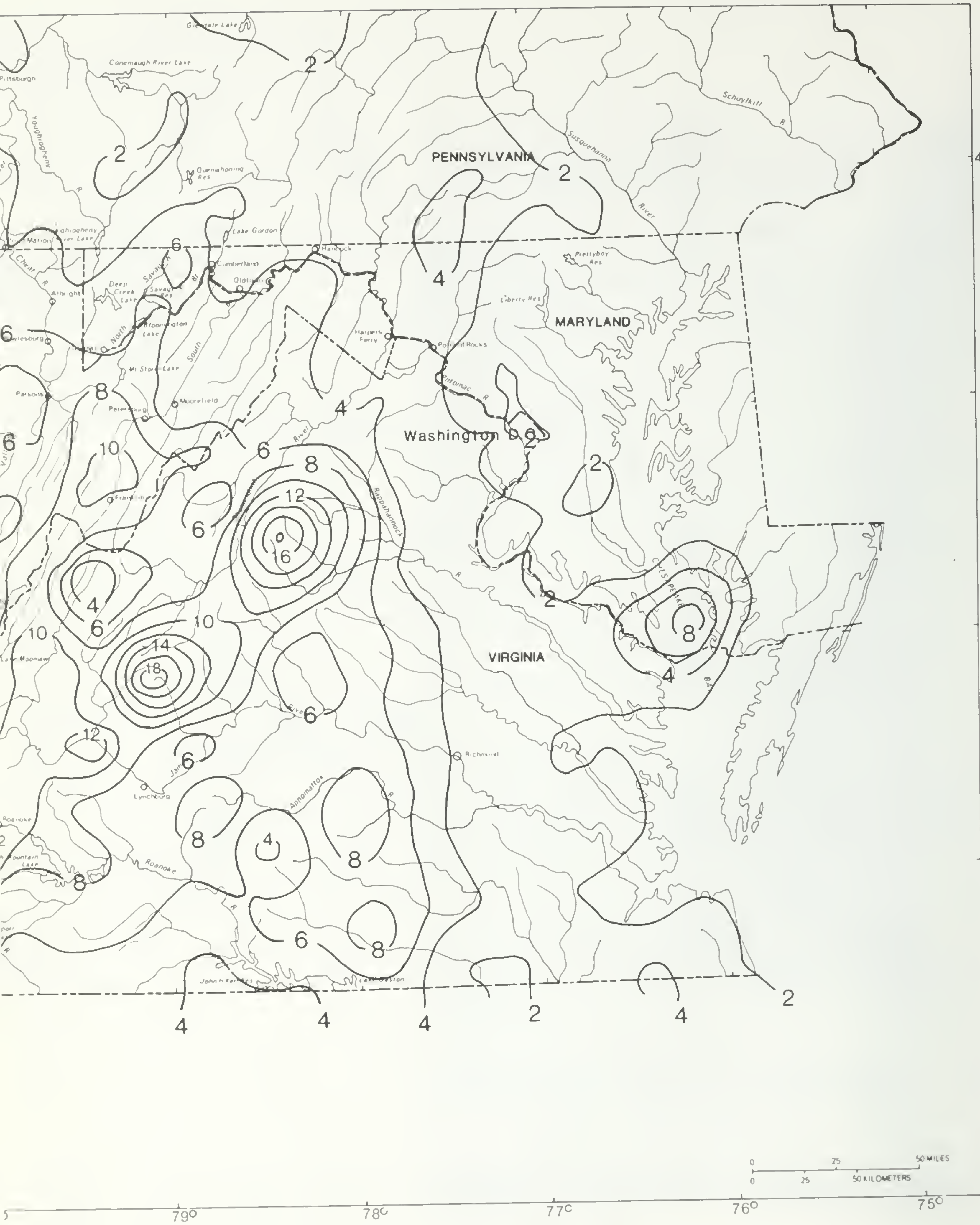



Figure 5.-- Total storm rainfall, October 31 - November 6, 1985.



PENNSYLVANIA
MARYLAND
VIRGINIA
Washington D.C.
Pittsburgh
Conemaugh River Lake
Youghiogheny
Quemahoning Res
Lake Gordon
Cumberland
Hancock
Schuylkill R
Susquehanna River
Prettyboy Res
Liberty Res
Harpers Ferry
Point of Rocks
Potomac R
Deep Creek Lake
Savage R
Parsons
Petersburg
Moorefield
Franklin
Rappahannock
Richmond
Lynchburg
Appomattox R
Roanoke
Lake Gaston
40°
39°
38°
37°
79°
78°
77°
76°
75°
0 25 50 MILES
0 25 50 KILOMETERS

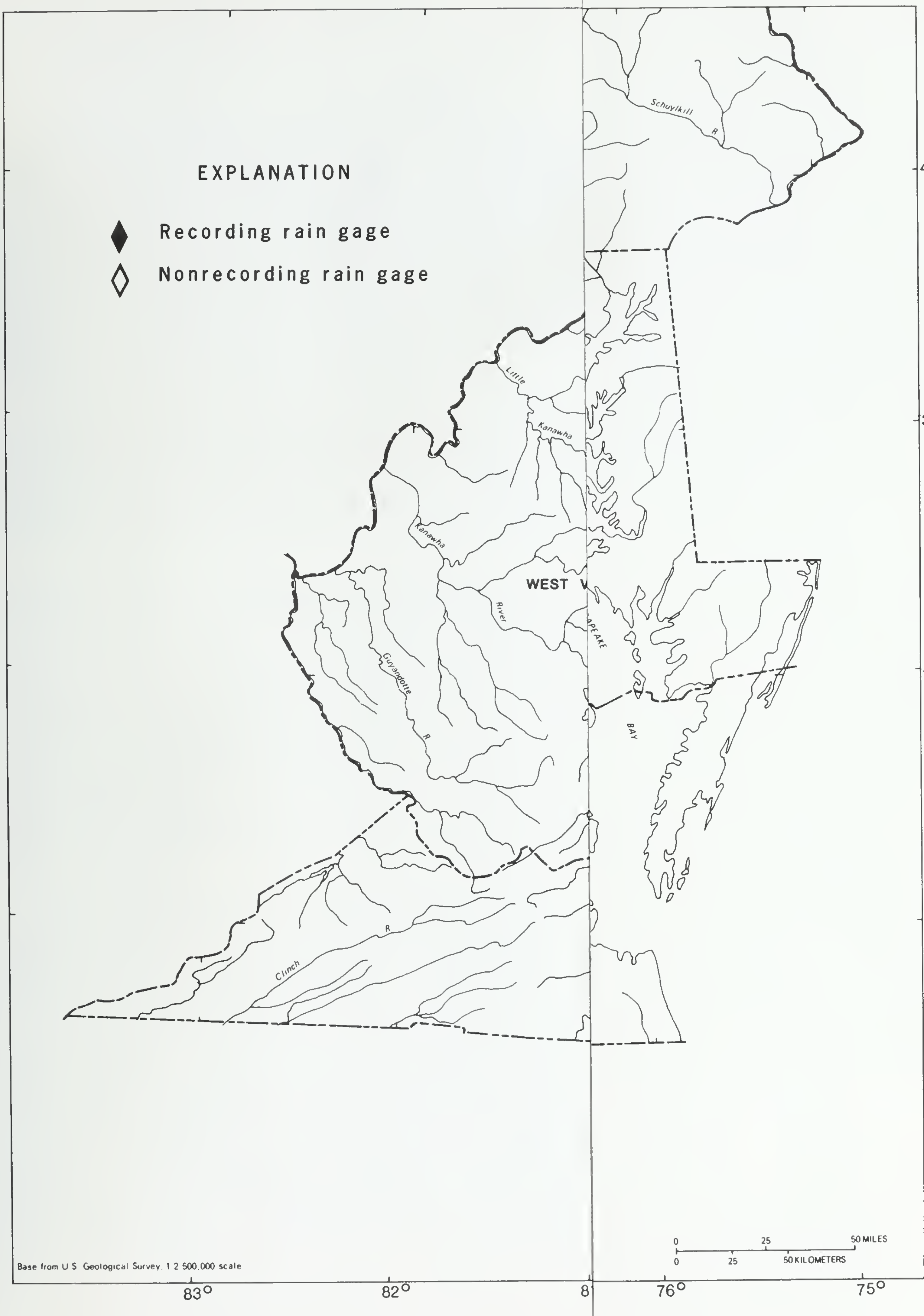



Figure 6.-- Location of selected rain gages.

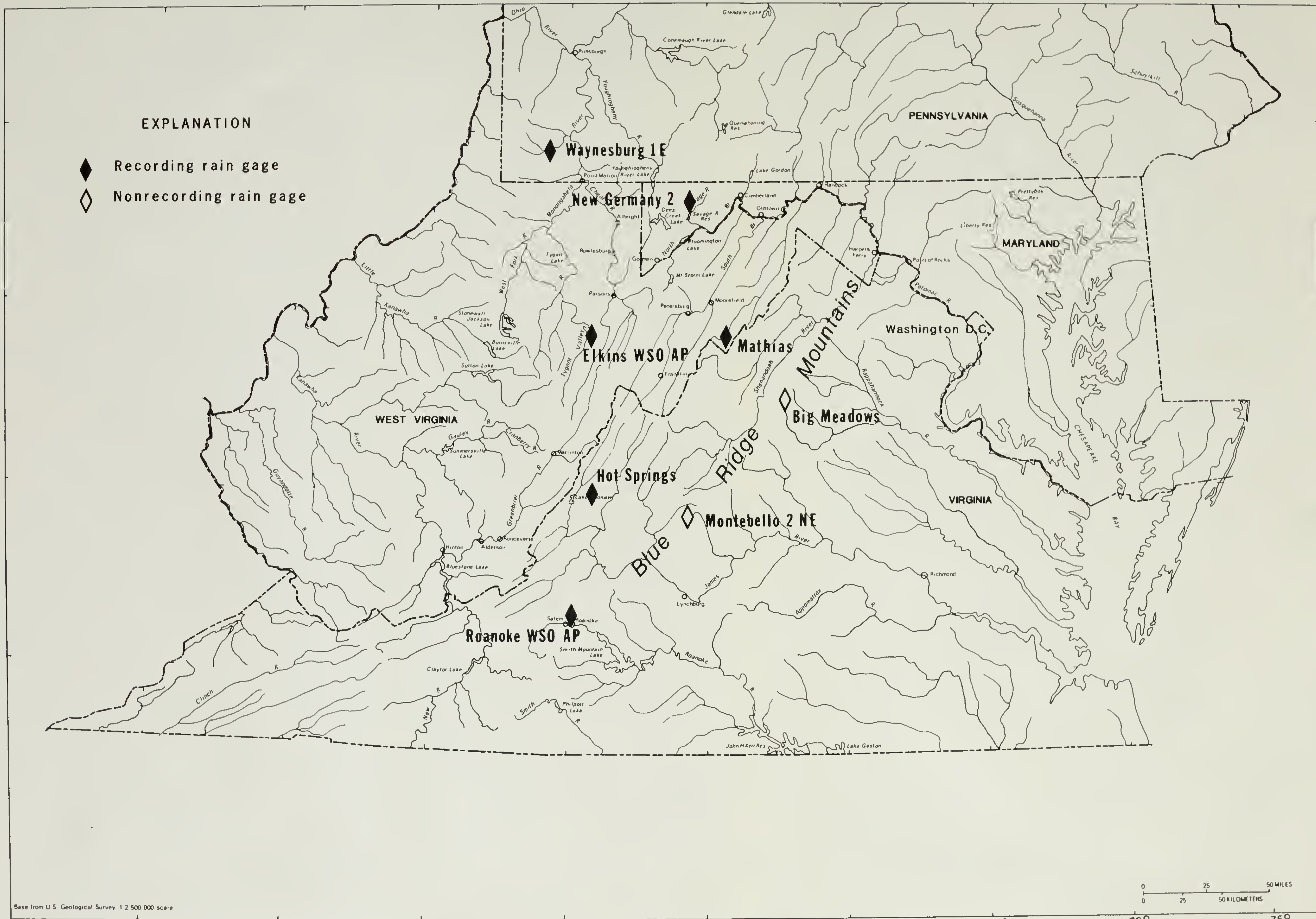



Figure 6.-- Location of selected rain gages.

## History

Juan was a rather typical late-season hurricane which matured in the Gulf of Mexico and moved ashore over coastal Louisiana and Mississippi early on the morning of October 31, 1985. Some distinguishing characteristics of this hurricane were its large size (for a hurricane) and its relatively moderate winds which only slightly exceeded 73 miles per hour (hurricane force) and did so only for a short time, which was prior to landfall. This storm was also notable in that it moved rather aimlessly off the Louisiana coast for a couple of days (October 29 and 30) before it moved inland. This hesitation was particularly significant because it resulted in a strong flow of moisture and heat into the study area, creating the potential for the excessive rainfall which occurred later.

After Hurricane Juan moved inland, it crossed southern Mississippi in a northeasterly direction and then continued on a more northerly path through northern Alabama, central Tennessee, Kentucky, and Indiana. The hurricane, in following this track, had sufficient energy to move the jetstream into a north-south orientation; as a result, even more moisture was carried northward, making the final storm even more intense and devastating.

On November 2, the remnants of the hurricane moved from Indiana into Michigan where it no longer directly contributed any significant rainfall to the study area. In the course of Juan's passage, generally less than 2 in. of rain fell throughout the four-State region except for 2 to 3 in. in a substantial area of south and west-central Virginia, and as much as 5 in. in two small areas of the Blue Ridge Mountains. This rainfall, which was associated with the hurricane, includes the rainfall related to the small, secondary low-pressure system which developed in connection with Juan's passage. The secondary system developed on November 1 in the vicinity of the Tennessee-North Carolina State line (along the warm frontal temperature discontinuity associated with the passage of Juan). This smaller system moved rapidly across North Carolina and out to sea, but was responsible for many of the greater rainfall totals in southern and central Virginia.

The third storm that developed moved inland from the Gulf of Mexico, and crossed the Florida panhandle on the morning of November 3. This system moved through central Georgia and South Carolina and then into southwestern North Carolina early on November 4. This third storm, an intense low-pressure system, was fed by excess moisture in the atmosphere brought in by the hurricane and by the associated secondary storm system. A massive rain shield developed to the north of this third low-pressure system as the abundant moist Gulf air overran the cooler air north of the system center. This intense low-pressure system tracked very slowly northward across southwestern Virginia to southeastern West Virginia on November 4. The storm then traveled in an east-northeasterly direction through the eastern panhandle of West Virginia and across northern Virginia and northern Maryland. This third system produced as much as 9 in. of rain in West Virginia and 12 in. in Virginia (official National Weather Services gages) on saturated ground.

## Distribution of Precipitation

Rainfall for the storm period (October 31-November 6) varied considerably over the four-State study area as shown on the isohyetal map in figure 5. This map was derived from a computer plot generated by an interpolating algorithm, MINC--a program widely used within the geophysical science community (Godson and Webring, 1982). The map was developed from rainfall data from the official network of U.S. National Weather Service precipitation gages in the four-State region. Because of orographic effects, somewhat more rainfall probably occurred in some areas than is reflected by the isohyetal map.

Rainfall in West Virginia, recorded by National Weather Service stations, ranged from 3 in. in the western part of the State to greater than 11 in. in the northeastern part of the State; 14 in. was recorded at an unofficial site in the eastern panhandle (Federal Emergency Management Agency, 1985c). Rainfall in the affected area of Virginia ranged from 4 in. in the east-central part of the State to greater than 18 in. at two separate locations in the Blue Ridge Mountains in the west-central part of the State. In the affected regions of Maryland and Pennsylvania, amounts ranged from 2 in. at various locations up to 7 in. at one site in western Maryland.

There is widespread belief within the technical community involved with the flood that actual rainfall in many ungaged areas exceeded the officially documented values by significant amounts, especially in West Virginia. Unfortunately, virtually no well-documented bucket survey data were available to augment the official National Weather Service network data. Graphs of accumulated rainfall values for the entire storm period (October 31-November 6) are presented in figures 7-9 for six representative sites (official recording rain gages) in the four-State area. The rain-gage locations are shown in figure 6.

# GENERAL DESCRIPTION OF FLOOD

The October-November 1985 storm period caused extremely severe flooding over large areas of West Virginia and Virginia. Flooding in Pennsylvania and Maryland was somewhat less severe and widespread but very damaging. Exclusive of indirectly related coastal flooding resulting from unusually high tides (damage estimated to be $35 million), this storm was the fourth most costly hurricane-type storm (tropical cyclone) in United States history. Sixty-two lives were lost, and damage was estimated to be $1,400 million. The damage has been exceeded only by Hurricane Agnes (1972), 117 lives lost and $3,103 million damages; Camille (1969), 258 lives lost and $1,421 million damages; and Betsy (1965), 75 lives lost and $1,420 million damages (Bailey, Patterson, and Paulhus, 1975). The costs of these three previous storms would, of course, be substantially greater if translated into the 1985 dollars of the subject event.

The most severe flooding of the November 1985 event occurred November 3-7 over an area encompassing eastern West Virginia, northern and west-central Virginia, the Maryland panhandle, and part of southwestern Pennsylvania. Peak stages and discharges for the flooding are presented in table 16 for selected gaging stations. Recurrence intervals also are

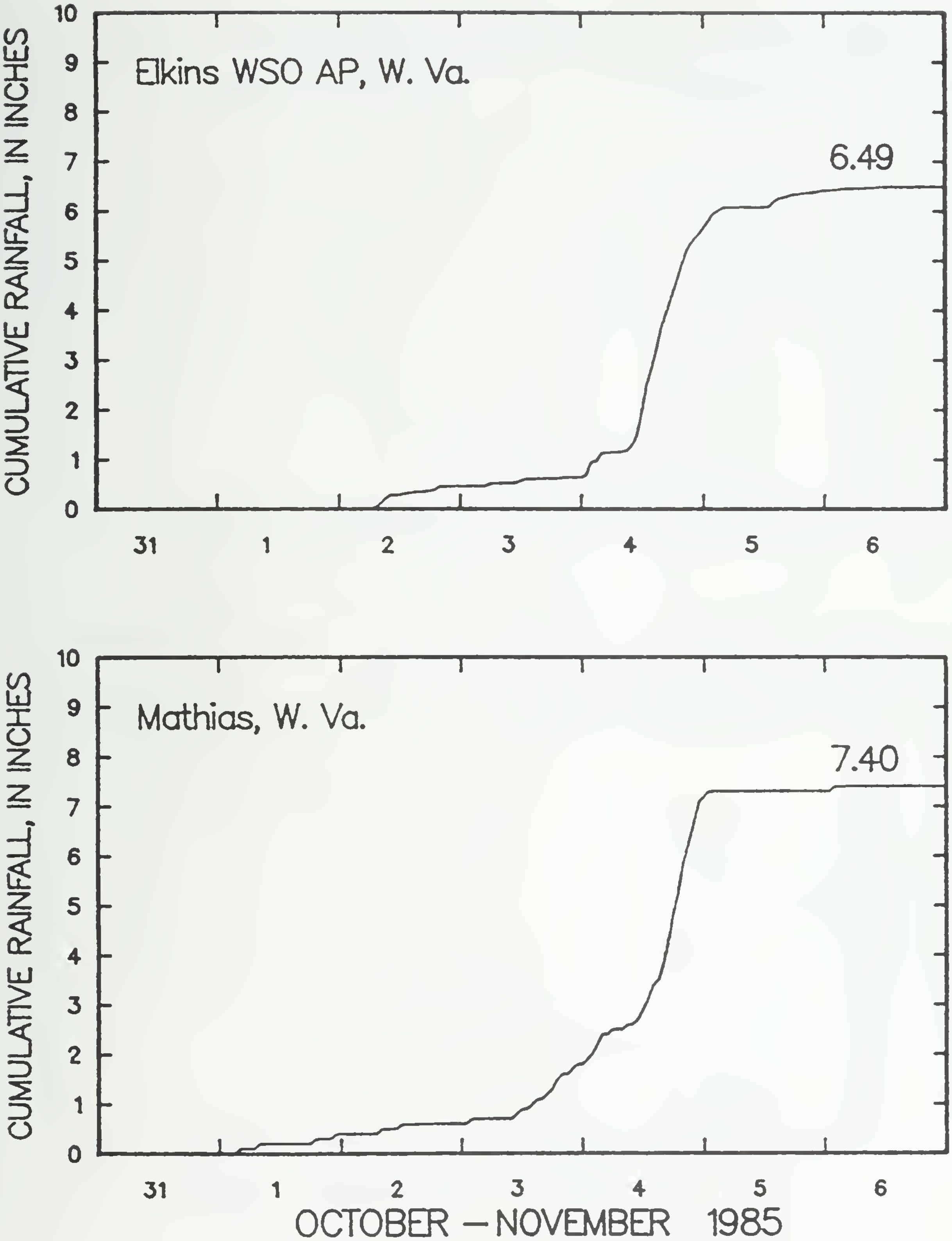



Figure 7.-- Rainfall mass curves for two gages in West Virginia, October 31 - November 6, 1985.

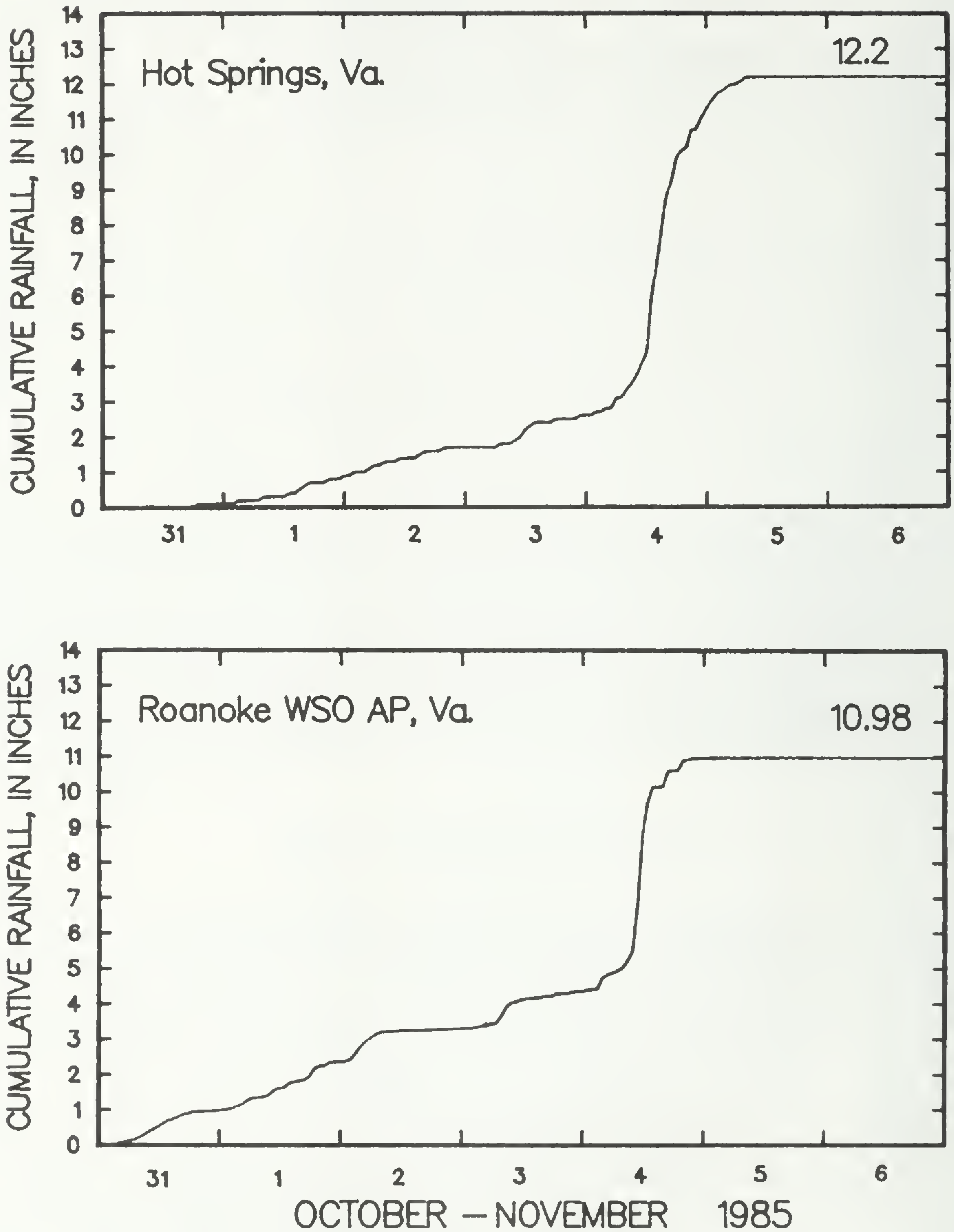



Figure 8.-- Rainfall mass curves for two gages in Virginia, October 31 - November 6, 1985.

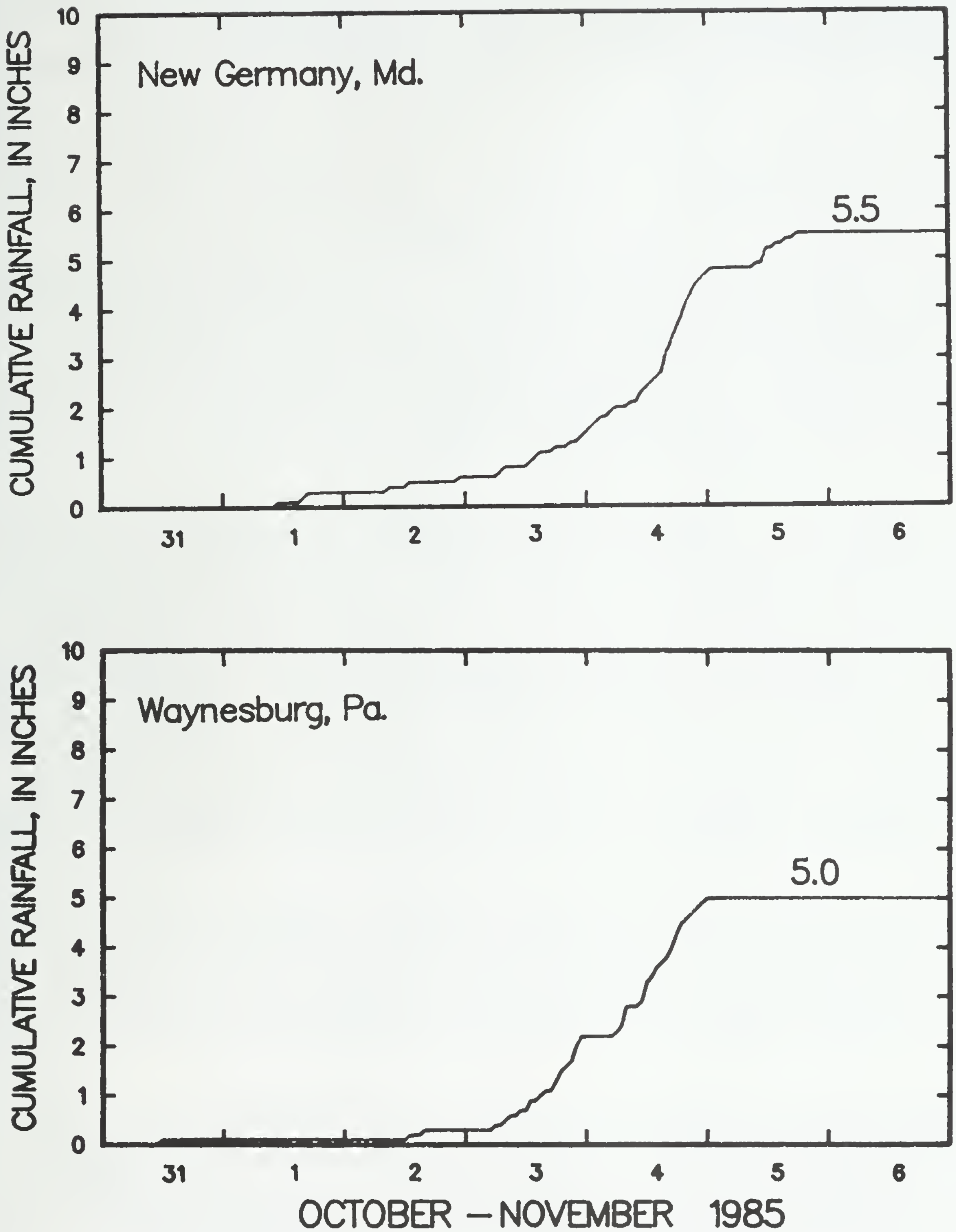



Figure 9.-- Rainfall mass curves for gages in Pennsylvania and Maryland, October 31 - November 6, 1985.

listed, along with previous maximum peaks of record at these stations. Recurrence intervals are described later in the section on Flood Frequency. Peak-discharge data for some miscellaneous sites also are given in table 16.

New maximum peak discharges were recorded at 63 gaging stations; peaks exceeded 100-year recurrence intervals at 63 sites. The 63 new record peaks were, on the average, 89 percent greater than the previous maximum discharges, exceeding the previous maximums by more than 50 percent at 40 stations.

In West Virginia, the Cheat River and South Branch Potomac River basins were particularly hard hit. For example, peak runoff of 170,000 $ft^3/s$ (cubic feet per second) from a 718-$mi^2$ (square mile) site was estimated in the Cheat River basin. Peaks up to 110,000 $ft^3/s$ from 283 $mi^2$ and 240,000 $ft^3/s$ from 1,471 $mi^2$ were recorded in the South Branch Potomac River basin. New maximum peak discharges occurred at 25 of the 50 gaging stations in the affected area of West Virginia. Peak flows equaling or exceeding 100-year recurrence intervals occurred at 27 of the 41 stations not affected by significant regulation. Damage was estimated to be $578 million and 38 people died as a result of the flooding in West Virginia (Federal Emergency Management Agency, 1985c).

In Virginia, the James River and the Roanoke River basins were especially hard hit. Peak discharges as high as 13,000 $ft^3/s$ from 13.6 $mi^2$, 25,200 $ft^3/s$ from 47.6 $mi^2$, and 179,000 $ft^3/s$ from 2,075 mi were documented in the James River basin. Peaks of 10,400 $ft^3/s$ from 11.7 $mi^2$ and 20,000 $ft^3/s$ from 56.8 $mi^2$ were recorded in the Roanoke River basin. New maximum peak discharges occurred at 34 of the 109 gaging stations in the affected area of Virginia. Peak flows equaling or exceeding 100-year recurrence intervals occurred at 32 of the 102 gaging stations having minimal or no regulation. A total of 22 deaths were attributed to the flooding in Virginia, and damage was estimated to be $753 million (Federal Emergency Management Agency, 1985b), including approximately $19 million estimated to have been caused by tide-related flooding in coastal areas.

In Pennsylvania, severe flooding occurred along the Monongahela River, with peak flow ranging up to 220,000 $ft^3/s$ from 4,407 $mi^2$ (gaging station at Greensboro). One fatality was attributed to the flooding in Pennsylvania, and damage was estimated to be $83 million (Federal Emergency Management Agency, 1985a).

In Maryland, the upper Potomac River basin experienced severe flooding, with peak discharges ranging as high as 50,400 $ft^3/s$ from 225 $mi^2$ and 235,000 $ft^3/s$ from 3,109 $mi^2$. One death resulted from the flooding in Maryland. Damage was estimated at $5 million, plus another $16 million related to tidal-coastal flooding (Maryland Emergency Management and Civil Defense Agency, written commun., 1986).

One extraordinary aspect of the November 1985 floods was the extremely high discharge rates that occurred in some of the larger drainage basins (in the 200- to 2,000-$mi^2$ range) in the South Branch Potomac and Cheat River basins. Peaks at these sites generally exceeded the largest peaks that resulted from Hurricane Agnes in similar size basins (Bailey, Patterson, and Paulhus, 1975). It is reasonable to infer, therefore, that the peaks of 170,000 $ft^3/s$, Cheat River at Parsons, West Virginia, and 240,000 $ft^3/s$, South Branch Potomac River near Springfield, West Virginia (sites 146 and 14, table 16), for example, were extremely rare events.

## FLOOD FREQUENCY

Flood-frequency information is an important consideration in the design of a wide variety of water-related structures including bridges, culverts, and dams, and also in design and management of all structures located in flood plains. Flood frequency is a general term usually used to indicate how often a given flood discharge will be exceeded during a given period of time. Because the terminology is widely understood and accepted, flood frequencies in this report are expressed in terms of recurrence intervals. A recurrence interval is defined as the average interval of years during which a given flood peak can be expected to be exceeded once. The recurrence interval is inversely related to the probability of the peak being exceeded in any given year. Thus, a flood with a 25-year recurrence interval would have 1 chance in 25, or a 4-percent probability, of being exceeded in any given year. Though unlikely, such a flood could occur 2 or even several years in a row. Probability terminology is sometimes used in describing flood frequencies to avoid any inference of regularity of occurrence.

Flood-frequency information is given in table 16 for gaging stations in this report. The flood-frequency data shown were determined using procedures recommended in U.S. Water Resources Council (1981). Flood-frequency information is not shown for a few stations because of insufficient length of record (nominally 10 years) at the sites. At some stations with short records, flood frequencies are given based on regional flood-frequency regression analyses. At sites where flood peaks are affected significantly by regulation, flood frequencies (recurrence intervals) are not shown because they generally are not meaningful and can be misleading.

At many of the stations, recurrence intervals for the November 1985 flood peaks were greater than 100 years. Because of the relatively short lengths of long-term record available at streamflow-gaging stations, flood-frequency estimates are not considered reliable beyond the 100-year recurrence interval. Therefore, at stations where peak discharge exceeded 100-year values, recurrence intervals are shown in table 16 as >100.

## DESCRIPTION OF FLOODING, BY STATE

### West Virginia

The storm period of October 31 through November 6, 1985, caused major flooding throughout eastern West Virginia in what was described by the Governor of the State as the worst flood in West Virginia history. Record-breaking floods occurred on several rivers within the Potomac, Monongahela, and Kanawha River basins. The most severe flooding occurred in the Cheat River and South Branch Potomac River basins. However, major flooding with record peaks also occurred in the Tygart, Greenbrier, and Little Kanawha River basins.

The flooding in the Cheat River basin was particularly devastating. Towns along the Cheat River suffered extremely heavy damage. Figures 10 and 11 reflect the aftermath of the flooding in Parsons and Rowlesburg, respectively. Figure 12 shows the town of Albright, W. Va., before and after much of it was destroyed. At five of the six streamflow-gaging stations operated in the Cheat River basin, the peak discharge exceeded the 100-year recurrence interval and also set a new record for magnitude (see table 16). The peak flow of 100,000 $ft^3/s$ at the gaging station Dry Fork at Hendricks was more than twice the previous maximum (47,000 $ft^3/s$), from records available since 1940, and the peak stage of 20.74 ft was more than 5 ft higher. The peak discharge of the Cheat River at Parsons, 170,000 $ft^3/s$, was more than double the previous maximum (82,000 $ft^3/s$), from records available since 1913. The peak discharge of the Cheat River at Rowlesburg, 190,000 $ft^3/s$, was 1.5 times the previous maximum of 125,000 $ft^3/s$ (in 1844). The 1985 peak at the gaging station Shavers Fork at Parsons, 43,000 $ft^3/s$ was 1.7 times the previous peaks of record (25,000 $ft^3/s$ in both 1888 and 1907). A discharge hydrograph of the flood at Shavers Fork at Parsons is shown in figure 13, with corresponding unit discharge values given in table 1.

Flooding in the South Branch Potomac River basin was also devastating, with flood peaks of extraordinary magnitude. The towns of Petersburg and Moorefield were particularly hard hit. At five of the six gaging stations operating in the South Branch Potomac basin, new peak discharge records were set (by wide margins), and at those five stations (all without significant upstream regulation) the peaks exceeded 100-year recurrence intervals. For example, the peak discharge of 44,000 $ft^3/s$ at the gaging station South Branch Potomac River at Franklin was nearly 3 times the previous maximum (15,000 $ft^3/s$), from records available since 1940, and the peak stage was 11 ft higher. The flood peak of 110,000 $ft^3/s$ at the gaging station South Fork South Branch Potomac River near Moorefield was 2.8 times the previous maximum discharge from records since 1928. The peak discharge at South Branch Potomac River near Springfield (240,000 $ft^3/s$) was almost twice the previous peak (143,000 $ft^3/s$), from records since 1894, and the peak stage was 10 ft higher. The peak discharge for the gage at South Fork South Branch Potomac River at Brandywine (40,500 $ft^3/s$) almost equaled the previous maximum (41,200 $ft^3/s$), from records since 1943. A discharge hydrograph for South Fork South Branch Potomac River at Brandywine is presented in figure 14, and the data are given in table 2.

Flooding on the Greenbrier River (in the Kanawha River basin) was very severe, causing extensive damage to the towns of Marlinton, Ronceverte, and Alderson. New peak-discharge records were set at all five gaging stations operated in the basin (by a wide margin at three stations). The peaks exceeded 100-year recurrence intervals at all five sites. The peak discharge of 37,100 $ft^3/s$ at the gaging station Greenbrier River at Durbin was over 3 times the previous maximum, 12,200 $ft^3/s$, from records since 1943, and the peak on the Greenbrier at Buckeye (82,000 $ft^3/s$) was twice the previous maximum (41,500 $ft^3/s$), from records since 1929. The peak flow at Greenbrier River at Alderson, 90,600 $ft^3/s$, was the largest peak from records since 1895, exceeding the previous maximum (1918) by 17 percent. Discharge hydrographs for the Greenbrier River gaging stations at Durbin, Buckeye, and Alderson are given in figures 15-17; unit discharge data are given in tables 3-5.

Flooding in the Tygart Valley River basin (tributary to the Monongahela River) set new records for peak discharge at all five of the long-term unregulated gaging stations in the basin (see table 16). However, the peaks were not as extreme, relative to the previous peaks of record, as those in the Cheat River and South Branch Potomac River basins. Recurrence intervals for the peaks equaled or exceeded 50 years at all five of the aforementioned sites in the Tygart basin, and four were in excess of 100 years. Also, at one newly established gaging station, Three Forks Creek near Grafton, the peak discharge, 12,000 $ft^3/s$, was estimated to exceed the 100-year recurrence interval. A discharge hydrograph for the flood at Tygart Valley River at Belington is shown in figure 18, and the corresponding unit discharge data are given in table 6.

The November 1985 storm also caused new peak discharges of record at four gaging stations not discussed thus far, two in the Kanawha River basin and two in the headwaters of the Little Kanawha River basin. The new maximums in the Kanawha River basin were at Gauley River near Craigsville (61,800 $ft^3/s$), operated since 1964, and at Elk River at Webster Springs (27,000 $ft^3/s$), operated from 1908 to 1916. In the Little Kanawha River basin, the new maximums were on the Little Kanawha River near Wildcat (10,500 $ft^3/s$), from records since 1973, and at Glenville (26,900 $ft^3/s$), from records on and off since 1915 and regulated since 1979.

One other gaged site, in the Potomac River basin, should receive special mention. The gaging station Stony River near Mount Storm, though highly regulated by two upstream reservoirs, still experienced a peak discharge of 14,000 $ft^3/s$ from only 48.8 $mi^2$. This discharge was nearly double the previous peak of record (7,300 $ft^3/s$), operated since 1961, and the peak stage was over 4 ft higher than the previous peak.

The damage from the November 1985 flood in West Virginia was extremely extensive. However, given the situation, with the worst flood in recent history (if not the worst ever) striking a region where most of the really livable land lies in the flood plain, widespread severe damage was virtually inevitable.

In West Virginia, 38 people lost their lives and damage was estimated at $578 million (Federal Emergency Management Agency, 1985c). A total of 29 counties (essentially the entire eastern half of the State) were included in the declaration of disaster areas by the Federal Government.

Nearly 9,000 homes were damaged by the flooding, of which more than 4,000 were completely destroyed. Thousands of acres of productive farmland were literally stripped of their topsoil, leaving broad expanses of boulders and rubble often over 3 ft thick. Agricultural losses alone were estimated to be $97 million. A total of 50 highway bridges were destroyed according to the West Virginia State Department of Highways, and damage to businesses was estimated at $118 million.

As severe as the damage was in West Virginia, it would have been significantly worse if not for the presence of several flood-control projects. According to the U.S. Army Corps of Engineers (Federal Emergency Management Agency, 1985c), Tygart and Stonewall Jackson Lakes on the Tygart Valley and West Fork Rivers, respectively, functioned to reduce flood damage by an estimated $69 million. Bluestone, Summersville, and Sutton Lakes were reported to have prevented flood damages of $62 million in the Kanawha River basin, and Burnsville Lake was estimated to have prevented $3.9 million in damages in the Little Kanawha basin.

Figure 10.-- Cheat River damage, Pennsylvania Avenue, Parsons, W. Va. (Photograph by Nancy J. Isner, The Inter-Mountain, Elkins, W. Va.)

Figure 11.-- Cheat River damage, railroad truss bridge, Rowlesburg, W. Va. (Photograph by Delbert Benson, Preston County Journal, and courtesy of McClain Printing Co., Parsons, W. Va.)

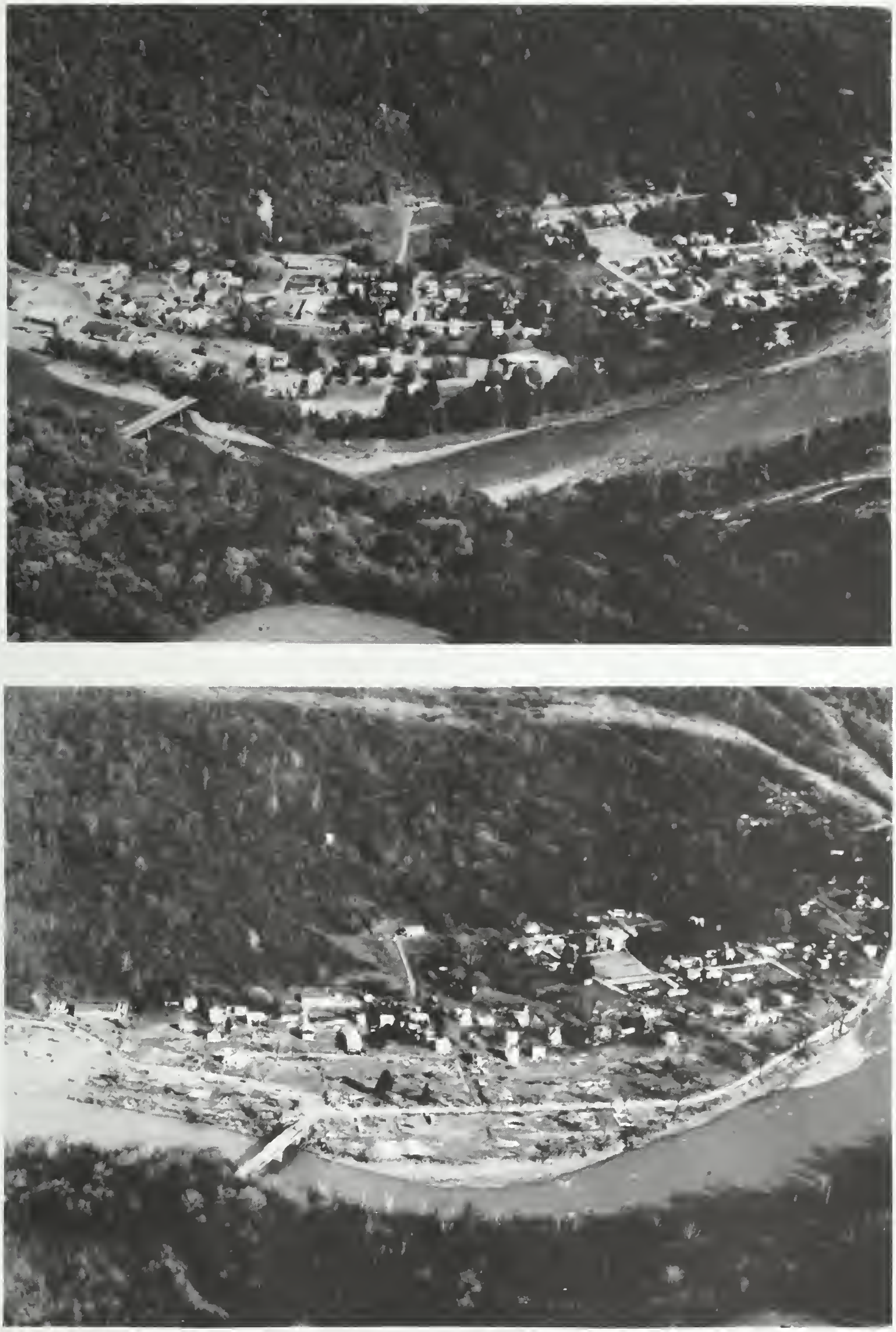


Figure 12.-- Cheat River damage, before and after flood at Albright, W. Va. (Photograph by Bob Sigler, Skyhawk Aerial Photos, Albright, W. Va., and courtesy of McClain Printing Co., Parsons, W. Va.)

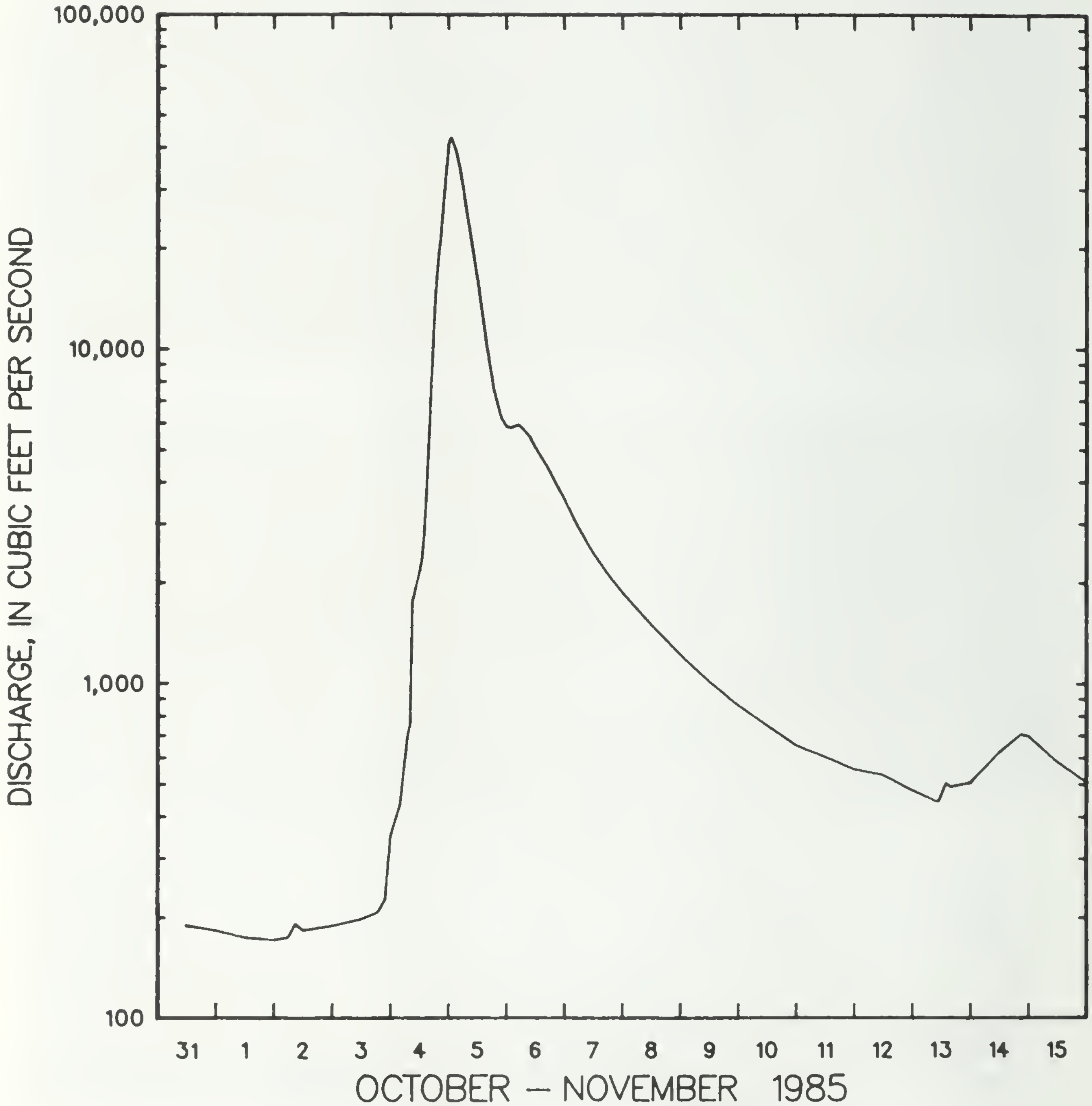



Figure 13.-- Discharge at gaging station Shavers Fork at Parsons, W. Va. (Site No. 145), October 31 - November 15, 1985.

Table 1.--Gage height and discharge for flood of November 1985 at gaging station Shavers Fork at Parsons, W. Va. (Site No. 145)

[ft = feet; $ft^3/s$ = cubic feet per second]

| Date | Time | Gage height (ft) | Discharge ($ft^3/s$) |
|---|---|---|---|
| October 31--------- | 1200 | 1.28 | 189 |
| | 2400 | 1.26 | 183 |
| November 1--------- | 1200 | 1.23 | 174 |
| | 2400 | 1.22 | 171 |
| November 2--------- | 0600 | 1.23 | 174 |
| | 0900 | 1.29 | 192 |
| | 1200 | 1.26 | 183 |
| | 2400 | 1.28 | 189 |
| November 3--------- | 1200 | 1.31 | 198 |
| | 1900 | 1.34 | 208 |
| | 2200 | 1.40 | 227 |
| | 2400 | 1.71 | 353 |
| November 4--------- | 0400 | 1.87 | 436 |
| | 0700 | 2.26 | 708 |
| | 0800 | 2.32 | 756 |
| | 0900 | 3.42 | 1,770 |
| | 1000 | 3.53 | 1,880 |
| | 1200 | 3.82 | 2,170 |
| | 1300 | 3.96 | 2,310 |
| | 1400 | 4.46 | 2,840 |
| | 1500 | 5.47 | 4,130 |
| | 1700 | 8.24 | 8,430 |
| | 1900 | 11.55 | 15,800 |
| | 2000 | 12.97 | 19,300 |
| | 2100 | 13.96 | 22,300 |
| | 2200 | 15.85 | 27,900 |
| | 2400 | 19.56 | 41,600 |
| November 5--------- | 0100 | 19.85 | 43,000 |
| | 0300 | 18.93 | 39,100 |
| | 0500 | 17.53 | 33,800 |
| | 0700 | 15.73 | 27,600 |
| | 0900 | 14.08 | 22,600 |
| | 1100 | 12.58 | 18,300 |
| | 1300 | 11.18 | 14,800 |
| | 1600 | 9.13 | 10,100 |
| | 1900 | 7.68 | 7,460 |
| | 2200 | 6.88 | 6,200 |
| | 2400 | 6.66 | 5,860 |
| November 6--------- | 0200 | 6.63 | 5,820 |
| | 0500 | 6.71 | 5,940 |
| | 0800 | 6.53 | 5,660 |
| | 1000 | 6.38 | 5,430 |
| | 1200 | 6.15 | 5,080 |
| | 1800 | 5.59 | 4,300 |
| | 2400 | 5.04 | 3,570 |
| November 7--------- | 0600 | 4.52 | 2,910 |
| | 1200 | 4.10 | 2,450 |
| | 1800 | 3.78 | 2,130 |
| | 2400 | 3.52 | 1,870 |
| November 8--------- | 1200 | 3.15 | 1,500 |
| | 2400 | 2.87 | 1,220 |
| November 9--------- | 1200 | 2.63 | 1,010 |
| | 2400 | 2.45 | 860 |
| November 10--------- | 1200 | 2.31 | 748 |
| | 2400 | 2.19 | 653 |
| November 11--------- | 1200 | 2.12 | 604 |
| | 2400 | 2.05 | 555 |
| November 12--------- | 1200 | 2.02 | 534 |
| | 2400 | 1.94 | 480 |
| November 13--------- | 1100 | 1.88 | 442 |
| | 1400 | 1.98 | 507 |
| | 1600 | 1.96 | 493 |
| | 2400 | 1.98 | 507 |
| November 14--------- | 1200 | 2.15 | 625 |
| | 2100 | 2.26 | 708 |
| | 2400 | 2.25 | 700 |
| November 15--------- | 1200 | 2.09 | 583 |
| | 2400 | 1.98 | 507 |

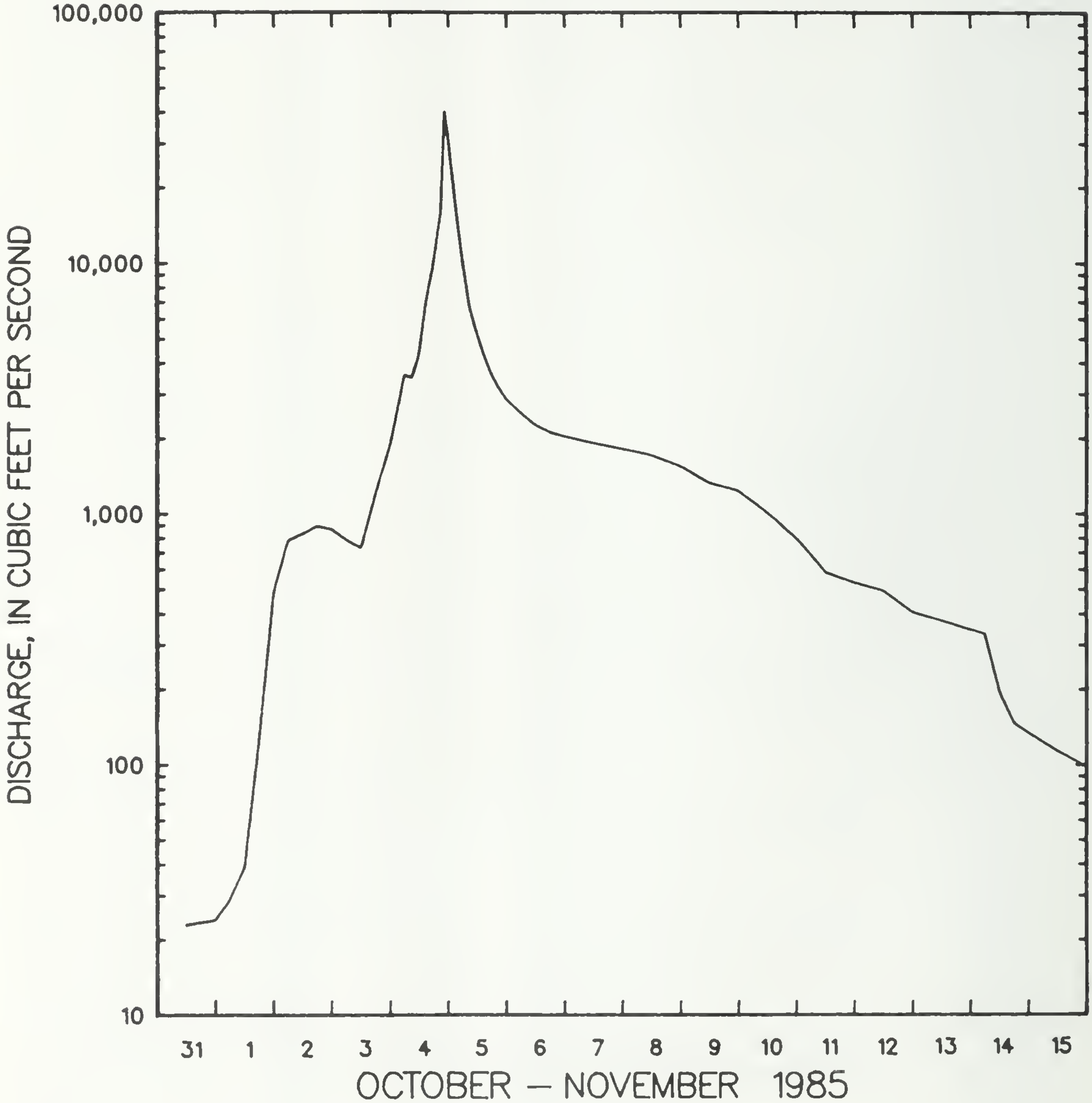



Figure 14.-- Discharge at gaging station South Fork South Branch Potomac River at Brandywine, W. Va. (Site No. 12), October 31 - November 15, 1985.

Table 2.--Gage height and discharge for flood of November 1985 at gaging station South Fork South Branch Potomac River at Brandywine, W. Va. (Site No. 12)

[ft = feet; $ft^3/s$ = cubic feet per second]

| Date | Time | Gage height (ft) | Discharge ($ft^3/s$) |
|---|---|---|---|
| October 31---------- | 1200 | 1.50 | 23 |
| | 2400 | 1.51 | 24 |
| November 1---------- | 0600 | 1.56 | 29 |
| | 1200 | 1.64 | 39 |
| | 1800 | 2.06 | 128 |
| | 2400 | 2.93 | 488 |
| November 2---------- | 0600 | 3.38 | 786 |
| | 1200 | 3.45 | 835 |
| | 1800 | 3.53 | 894 |
| | 2400 | 3.50 | 870 |
| November 3---------- | 0600 | 3.38 | 786 |
| | 1200 | 3.30 | 730 |
| | 1800 | 3.91 | 1,210 |
| | 2400 | 4.64 | 1,920 |
| November 4---------- | 0300 | 5.28 | 2,640 |
| | 0600 | 6.08 | 3,600 |
| | 0900 | 6.00 | 3,500 |
| | 1200 | 6.65 | 4,340 |
| | 1500 | 8.55 | 7,080 |
| | 1800 | 10.27 | 10,000 |
| | 2100 | 13.00 | 16,000 |
| | 2230 | 18.42 | 40,500 |
| | 2400 | 16.85 | 31,200 |
| November 5---------- | 0300 | 13.35 | 17,000 |
| | 0600 | 10.33 | 10,200 |
| | 0900 | 8.25 | 6,600 |
| | 1200 | 7.29 | 5,210 |
| | 1500 | 6.55 | 4,220 |
| | 1800 | 6.05 | 3,560 |
| | 2100 | 5.71 | 3,150 |
| | 2400 | 5.47 | 2,860 |
| November 6---------- | 0600 | 5.18 | 2,520 |
| | 1200 | 4.95 | 2,260 |
| | 1800 | 4.82 | 2,120 |
| | 2400 | 4.75 | 2,040 |
| November 7---------- | 1200 | 4.64 | 1,920 |
| | 2400 | 4.55 | 1,820 |
| November 8---------- | 1200 | 4.45 | 1,720 |
| | 2400 | 4.28 | 1,550 |
| November 9---------- | 1200 | 4.04 | 1,330 |
| | 2400 | 3.95 | 1,240 |
| November 10--------- | 1200 | 3.68 | 1,010 |
| | 2400 | 3.40 | 800 |
| November 11--------- | 1200 | 3.09 | 584 |
| | 2400 | 3.00 | 530 |
| November 12--------- | 1200 | 2.94 | 494 |
| | 2400 | 2.79 | 405 |
| November 13--------- | 1200 | 2.73 | 375 |
| | 2400 | 2.67 | 346 |
| November 14--------- | 0600 | 2.64 | 333 |
| | 1200 | 2.28 | 194 |
| | 1800 | 2.12 | 146 |
| | 2400 | 2.08 | 134 |
| November 15--------- | 1200 | 2.01 | 113 |
| | 2400 | 1.95 | 98 |

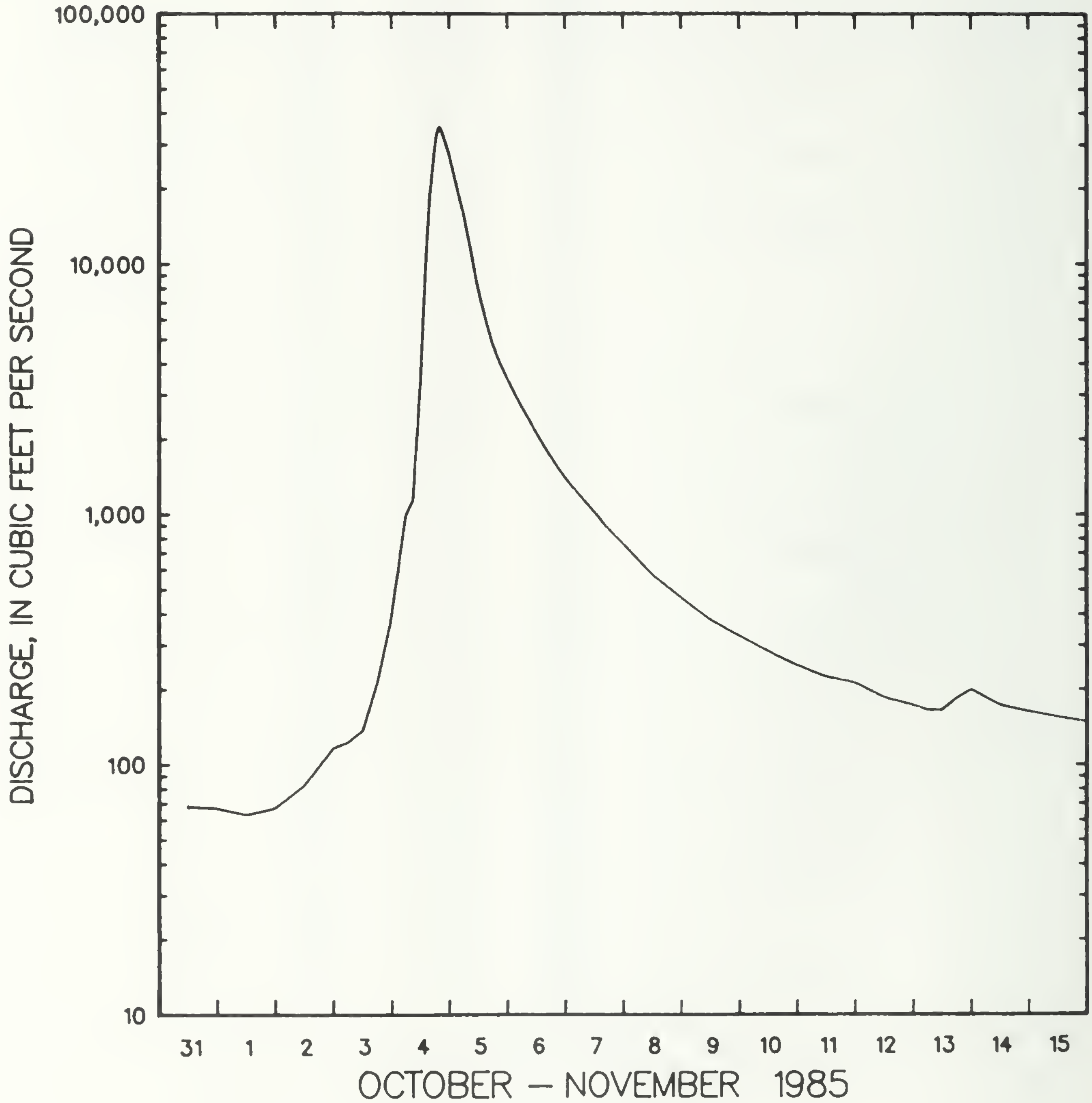



Figure 15.-- Discharge at gaging station Greenbriar River at Durbin, W. Va. (Site No. 178), October 31 - November 15, 1985.

Table 3.--Gage height and discharge for flood of November 1985 at gaging station Greenbrier River at Durbin, W. Va. (Site No. 178)

[ft = feet; $ft^3/s$ = cubic feet per second]

| Date | Time | Gage height (ft) | Discharge ($ft^3/s$) |
|---|---|---|---|
| October 31---------- | 1200 | 1.35 | 68 |
| | 2400 | 1.34 | 67 |
| November 1---------- | 1200 | 1.32 | 63 |
| | 2400 | 1.34 | 67 |
| November 2---------- | 1200 | 1.43 | 83 |
| | 2400 | 1.61 | 117 |
| November 3---------- | 0600 | 1.64 | 123 |
| | 1200 | 1.71 | 137 |
| | 1800 | 1.99 | 212 |
| | 2400 | 2.48 | 392 |
| November 4---------- | 0300 | 2.91 | 606 |
| | 0600 | 3.50 | 1,000 |
| | 0900 | 3.68 | 1,140 |
| | 1200 | 5.47 | 3,450 |
| | 1500 | 9.56 | 13,400 |
| | 1600 | 11.40 | 19,000 |
| | 1800 | 14.36 | 30,400 |
| | 1900 | 15.15 | 33,800 |
| | 2000 | [a]15.50 | [b]35,500 |
| | 2100 | 15.09 | 33,500 |
| | 2400 | 13.49 | 27,000 |
| November 5---------- | 0300 | 11.77 | 20,200 |
| | 0600 | 10.27 | 15,500 |
| | 0900 | 8.85 | 11,300 |
| | 1200 | 7.54 | 7,900 |
| | 1500 | 6.69 | 6,020 |
| | 1800 | 6.11 | 4,740 |
| | 2100 | 5.76 | 3,980 |
| | 2400 | 5.47 | 3,450 |
| November 6---------- | 0600 | 4.99 | 2,680 |
| | 1200 | 4.62 | 2,110 |
| | 1800 | 4.29 | 1,690 |
| | 2400 | 3.99 | 1,390 |
| November 7---------- | 0600 | 3.74 | 1,190 |
| | 1200 | 3.53 | 1,020 |
| | 1800 | 3.34 | 872 |
| | 2400 | 3.17 | 762 |
| November 8---------- | 1200 | 2.85 | 575 |
| | 2400 | 2.63 | 465 |
| November 9---------- | 1200 | 2.45 | 380 |
| | 2400 | 2.32 | 328 |
| November 10--------- | 1200 | 2.21 | 284 |
| | 2400 | 2.11 | 249 |
| November 11--------- | 1200 | 2.03 | 224 |
| | 2400 | 1.99 | 212 |
| November 12--------- | 1200 | 1.90 | 185 |
| | 2400 | 1.85 | 173 |
| November 13--------- | 0600 | 1.82 | 165 |
| | 1200 | 1.82 | 165 |
| | 1800 | 1.90 | 185 |
| | 2400 | 1.95 | 200 |
| November 14--------- | 1200 | 1.85 | 173 |
| | 2400 | 1.81 | 163 |
| November 15--------- | 1200 | 1.78 | 155 |
| | 2400 | 1.75 | 148 |

[a] Peak stage, 15.82 ft (probably between 1900 and 2000 hours); see table 16.

[b] Peak discharge, 37,100 $ft^3/s$; see table 16.

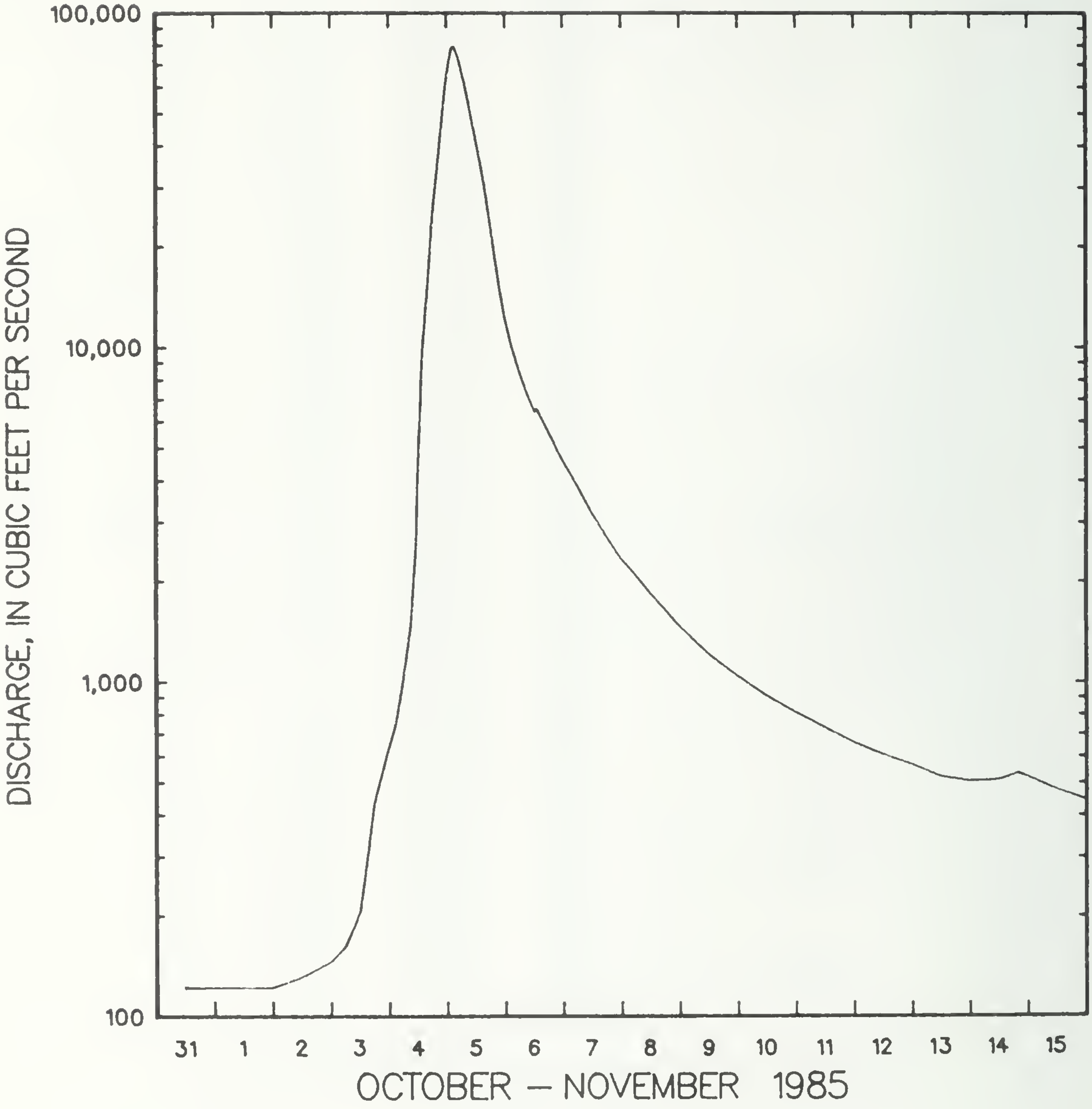



Figure 16.-- Discharge at gaging station Greenbriar River at Buckeye, W. Va. (Site No. 180), October 31 - November 15, 1985.

Table 4.--Gage height and discharge for flood of November 1985 at gaging station Greenbrier River at Buckeye, W. Va. (Site No. 180)

[ft = feet; $ft^3/s$ = cubic feet per second]

| Date | Time | Gage height (ft) | Discharge ($ft^3/s$) |
|---|---|---|---|
| October 31---------- | 1200 | 2.09 | 122 |
| | 2400 | 2.09 | 122 |
| November 1---------- | 1200 | 2.09 | 122 |
| | 2400 | 2.09 | 122 |
| November 2---------- | 1200 | 2.12 | 131 |
| | 2400 | 2.17 | 146 |
| November 3---------- | 0600 | 2.22 | 162 |
| | 1200 | 2.34 | 206 |
| | 1800 | 2.87 | 445 |
| | 2400 | 3.26 | 646 |
| November 4---------- | 0300 | 3.46 | 766 |
| | 0600 | 3.87 | 1,040 |
| | 0900 | 4.46 | 1,490 |
| | 1100 | 5.51 | 2,540 |
| | 1200 | 7.05 | 4,790 |
| | 1400 | 9.52 | 10,100 |
| | 1600 | 11.31 | 15,100 |
| | 1800 | 14.45 | 25,700 |
| | 2100 | 17.68 | 40,100 |
| | 2400 | 21.31 | 64,500 |
| November 5---------- | 0200 | 22.83 | 78,300 |
| | 0300 | [a]22.95 | [b]79,500 |
| | 0500 | 22.31 | 73,100 |
| | 0800 | 20.56 | 58,700 |
| | 1000 | 19.21 | 49,400 |
| | 1200 | 17.88 | 41,200 |
| | 1500 | 15.86 | 31,800 |
| | 1800 | 13.75 | 23,100 |
| | 2000 | 12.29 | 18,200 |
| | 2200 | 11.13 | 14,600 |
| | 2400 | 10.31 | 12,100 |
| November 6---------- | 0300 | 9.46 | 9,900 |
| | 0600 | 8.85 | 8,380 |
| | 0900 | 8.31 | 7,220 |
| | 1200 | 7.90 | 6,400 |
| | 1300 | 7.97 | 6,540 |
| | 1800 | 7.44 | 5,490 |
| | 2400 | 6.89 | 4,540 |
| November 7---------- | 0600 | 6.41 | 3,820 |
| | 1200 | 5.98 | 3,170 |
| | 1800 | 5.63 | 2,700 |
| | 2400 | 5.32 | 2,320 |
| November 8---------- | 1200 | 4.84 | 1,840 |
| | 2400 | 4.42 | 1,460 |
| November 9---------- | 1200 | 4.11 | 1,210 |
| | 2400 | 3.87 | 1,040 |
| November 10--------- | 1200 | 3.68 | 907 |
| | 2400 | 3.53 | 810 |
| November 11--------- | 1200 | 3.40 | 730 |
| | 2400 | 3.28 | 658 |
| November 12--------- | 1200 | 3.19 | 605 |
| | 2400 | 3.11 | 565 |
| November 13--------- | 1200 | 3.02 | 520 |
| | 2400 | 2.99 | 505 |
| November 14--------- | 1200 | 3.00 | 510 |
| | 2000 | 3.05 | 535 |
| | 2400 | 3.02 | 520 |
| November 15--------- | 1200 | 2.93 | 475 |
| | 2400 | 2.87 | 445 |

[a] Peak stage, 23.2 ft (probably between 0200 and 0300 hours); see table 16.

[b] Peak discharge, 82,000 $ft^3/s$; see table 16.

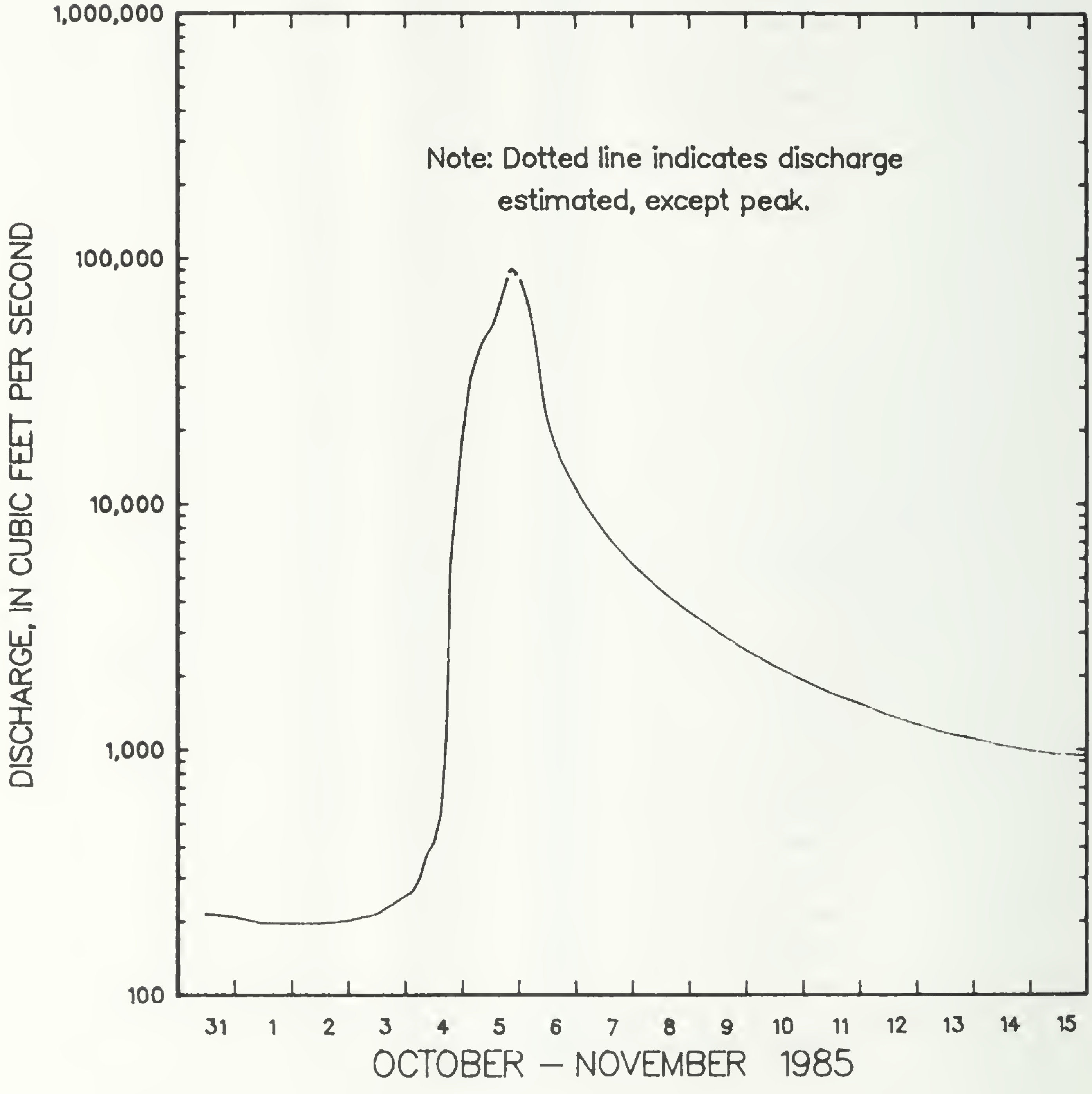



Figure 17.-- Discharge at gaging station Greenbriar River at Alderson, W. Va. (Site No. 181), October 31 - November 15, 1985.

Table 5.--Gage height and discharge for flood of November 1985 at gaging station Greenbrier River at Alderson, W. Va. (Site No. 181)

[ft = feet; $ft^3/s$ = cubic feet per second; dash indicates that gage height was not determined]

| Date | Time | Gage height (ft) | Discharge ($ft^3/s$) |
|---|---|---|---|
| October 31---------- | 1200 | 2.37 | 214 |
| | 2400 | 2.36 | 209 |
| November 1---------- | 1200 | 2.33 | 196 |
| | 2400 | 2.33 | 196 |
| November 2---------- | 1200 | 2.33 | 196 |
| | 2400 | 2.34 | 201 |
| November 3---------- | 1200 | 2.37 | 214 |
| | 2400 | 2.45 | 254 |
| November 4---------- | 0300 | 2.47 | 264 |
| | 0600 | 2.53 | 298 |
| | 0900 | 2.65 | 375 |
| | 1200 | 2.71 | 418 |
| | 1500 | 2.87 | 553 |
| | 1700 | 3.34 | 1,090 |
| | 1800 | 3.99 | 2,120 |
| | 1900 | 5.56 | 5,610 |
| | 2100 | 6.85 | 9,350 |
| | 2300 | 8.58 | 14,700 |
| | 2400 | 9.81 | 19,000 |
| November 5---------- | 0300 | 13.01 | 30,200 |
| | 0400 | 13.98 | 33,600 |
| | 0600 | 15.47 | 39,100 |
| | 0900 | 17.16 | 46,600 |
| | 1200 | 18.30 | 51,500 |
| | 1300 | 18.67 | 53,400 |
| | 1500 | 19.91 | 60,500 |
| | 1800 | 22.41 | 77,300 |
| | 1900 | 23.09 | 82,800 |
| | 2000 | - | [a]88,500 |
| | [a]2100 | 23.95 | 90,600 |
| | 2200 | - | [a]89,400 |
| | 2300 | - | [a]87,400 |
| | 2400 | - | [a]84,500 |
| November 6---------- | 0100 | 22.87 | 81,000 |
| | 0200 | 22.25 | 76,000 |
| | 0400 | 20.74 | 65,400 |
| | 0600 | 18.64 | 53,200 |
| | 0900 | 13.78 | 32,900 |
| | 1000 | 12.35 | 27,900 |
| | 1100 | 11.29 | 24,200 |
| | 1200 | 10.57 | 21,700 |
| | 1500 | 9.36 | 17,500 |
| | 1800 | 8.61 | 14,800 |
| | 2100 | 8.05 | 13,000 |
| | 2400 | 7.60 | 11,600 |
| November 7---------- | 0300 | 7.18 | 10,300 |
| | 0600 | 6.83 | 9,290 |
| | 1200 | 6.30 | 7,700 |
| | 1800 | 5.90 | 6,530 |
| | 2400 | 5.59 | 5,690 |
| November 8---------- | 1200 | 5.10 | 4,450 |
| | 2400 | 4.74 | 3,630 |
| November 9---------- | 1200 | 4.46 | 3,020 |
| | 2400 | 4.22 | 2,540 |
| November 10--------- | 1200 | 4.03 | 2,190 |
| | 2400 | 3.88 | 1,920 |
| November 11--------- | 1200 | 3.75 | 1,690 |
| | 2400 | 3.66 | 1,540 |
| November 12--------- | 1200 | 3.56 | 1,380 |
| | 2400 | 3.48 | 1,270 |
| November 13--------- | 1200 | 3.41 | 1,170 |
| | 2400 | 3.36 | 1,110 |
| November 14--------- | 1200 | 3.30 | 1,040 |
| | 2400 | 3.26 | 992 |
| November 15--------- | 1200 | 3.23 | 956 |
| | 2400 | 3.22 | 944 |

[a] Estimated.

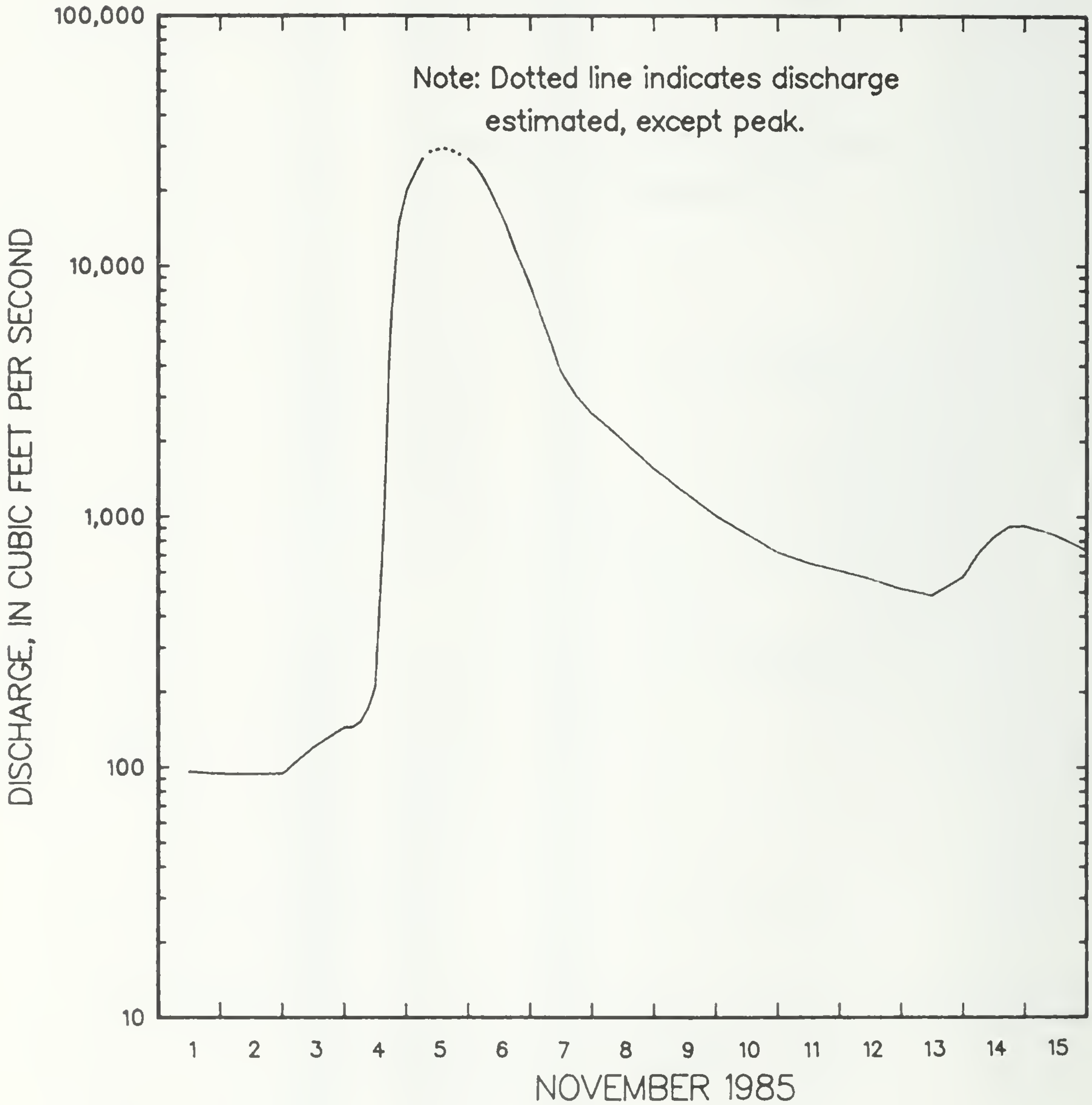



Figure 18.-- Discharge at gaging station Tygart Valley River at Belington, W. Va. (Site No. 132), November 1-15, 1985.

Table 6.--Gage height and discharge for flood of November 1985 at gaging station Tygart Valley River at Belington, W. Va. (Site No. 132)

[ft = feet; $ft^3/s$ = cubic feet per second; dash indicates that gage height was not determined]

| Date | Time | Gage height (ft) | Discharge ($ft^3/s$) |
|---|---|---|---|
| November 1---------- | 1200 | 2.76 | 96 |
| | 2400 | 2.75 | 94 |
| November 2---------- | 1200 | 2.75 | 94 |
| | 2400 | 2.75 | 94 |
| November 3---------- | 1200 | 2.84 | 120 |
| | 2400 | 2.91 | 144 |
| November 4---------- | 0300 | 2.91 | 144 |
| | 0600 | 2.93 | 151 |
| | 0900 | 2.98 | 170 |
| | 1200 | 3.08 | 210 |
| | 1500 | 4.30 | 840 |
| | 1800 | 10.45 | 5,760 |
| | 2100 | 17.00 | 14,800 |
| | 2400 | 19.63 | 20,000 |
| November 5---------- | 0300 | 21.08 | 23,300 |
| | 0600 | 22.50 | 26,700 |
| | 0900 | - | [a]28,600 |
| | 1200 | - | [a]29,200 |
| | 1500 | 23.65 | 29,500 |
| | 1800 | - | [a]28,900 |
| | 2100 | - | [a]27,800 |
| | 2400 | 22.52 | 26,700 |
| November 6---------- | 0300 | 21.78 | 25,000 |
| | 0600 | 20.73 | 22,400 |
| | 0900 | 19.42 | 19,500 |
| | 1200 | 18.05 | 16,800 |
| | 1500 | 16.70 | 14,300 |
| | 1800 | 15.00 | 11,700 |
| | 2100 | 13.75 | 9,950 |
| | 2400 | 12.62 | 8,440 |
| November 7---------- | 0600 | 10.32 | 5,620 |
| | 1200 | 8.49 | 3,810 |
| | 1800 | 7.54 | 3,030 |
| | 2400 | 6.95 | 2,570 |
| November 8---------- | 0600 | 6.54 | 2,290 |
| | 1200 | 6.15 | 2,010 |
| | 1800 | 5.80 | 1,770 |
| | 2400 | 5.49 | 1,550 |
| November 9---------- | 1200 | 5.00 | 1,250 |
| | 2400 | 4.60 | 1,010 |
| November 10--------- | 1200 | 4.32 | 851 |
| | 2400 | 4.08 | 719 |
| November 11--------- | 1200 | 3.96 | 653 |
| | 2400 | 3.88 | 609 |
| November 12--------- | 1200 | 3.80 | 565 |
| | 2400 | 3.71 | 515 |
| November 13--------- | 1200 | 3.65 | 485 |
| | 2400 | 3.82 | 576 |
| November 14--------- | 0600 | 4.08 | 719 |
| | 1200 | 4.29 | 834 |
| | 1800 | 4.44 | 917 |
| | 2400 | 4.45 | 922 |
| November 15--------- | 1200 | 4.31 | 845 |
| | 2400 | 4.11 | 735 |

[a] Estimated.

## Virginia

The November 1985 storm produced severe flooding over a large part of Virginia. The worst flooding was in the west-central and north-central parts of the State, but major runoff-related damage occurred as far east as Richmond. New peaks of record occurred on several streams within the Roanoke, James, and Shenandoah River basins. The most severe damage was confined to the Roanoke and James River basins, though record-breaking peaks and widespread flooding did occur in the Shenandoah River basin.

The most extensive damage in Virginia occurred in the Roanoke River basin, primarily in the Roanoke-Salem metropolitan area. Figures 19 and 20 illustrate to some extent the severity of the flooding there. New peak-discharge records were set at six gaging stations and 100-year recurrence intervals were exceeded at five of those stations (table 16). At the gaging station Roanoke River at Roanoke, the peak flow of 32,300 $ft^3/s$ exceeded the previous maximum (25,300 $ft^3/s$) by over 25 percent, from records since 1899, and the peak stage was 3.7 ft higher. The peak flow of 52,300 $ft^3/s$ at Roanoke River at Niagara was over 75 percent greater than the previous maximum, from records since 1926, and the stage of 25.3 ft was over 6 ft higher. At another station, Tinker Creek near Daleville, a unit discharge of 890 $(ft^3/s)/mi^2$ (cubic feet per second per square mile) was recorded from 11.7 $mi^2$. At this station, the peak discharge of 10,400 $ft^3/s$ was 2.6 times the previous maximum, from records since 1956. A discharge hydrograph for the flood at Roanoke River at Niagara is shown in figure 21, and discharge data are given in table 7.

Severe flooding was widespread in the James River basin. The city of Lynchburg was particularly hard hit, with stages 7 ft higher than the previous flood of record, in 1877. New peaks of record occurred at many locations from the headwaters of the James River downstream to the main-stem station at Bent Creek. Farther downstream, the November 1985 peaks, though still extremely large, generally were smaller than those from Hurricanes Agnes and Camille. At the gaging station James River at Scottsville, the recurrence interval exceeded 100 years, but the discharge, 243,000 $ft^3/s$, was considerably less than the 301,000 $ft^3/s$ peak from Hurricane Agnes. Flooding in Richmond was extensive, but not nearly as severe as the flooding that resulted from Agnes in June 1972, the peak stage of which was 4 ft higher than that in November 1985.

In the upper reaches of the James River basin, new records of peak discharge were set at 15 of the 24 essentially unregulated stations upstream from (and including) the gage at Bent Creek. Flood peaks exceeded 100-year recurrence intervals at 17 of those stations. At the gaging station Catawba Creek near Catawba, the discharge of 21,200 $ft^3/s$ (from 34.3 $mi^2$) was 2.7 times the previous maximum of 7,740 $ft^3/s$ (and the stage was 8.8 ft higher), from records since 1943. The peak at Maury River at Rockbridge Baths, 87,700 $ft^3/s$, was 2.7 times the previous peak of record and the stage was 6.1 ft higher, from records since 1928. Peak discharges on the main-stem James River gaging stations at Buchanan, Holcombs Rock, and Bent Creek all exceeded the previous maximums by at least 25 percent and stages were from 3.6 to 6.6 ft higher than the previous peak stages.

Discharge hydrographs for the James River basin gaging stations Back

Creek near Sunrise, Calfpasture River above Mill Creek at Goshen, and James River at Holcombs Rock are presented in figures 22 to 24, and corresponding discharge data are given in tables 8 to 10.

Flooding in the Shenandoah River basin was not as severe as in the James River basin. Figure 25 shows the flooding at Harpers Ferry, W. Va., at the confluence of the Shenandoah and Potomac Rivers.

Peak discharges set new records at 13 of the 24 streamflow measuring stations in the Shenandoah River basin and exceeded 100-year recurrence intervals at 9 stations. The peak discharge at the gaging station Middle River near Verona, 45,000 $ft^3/s$, was greater than five times the previous maximum (8,650 $ft^3/s$), from records since 1968, and the stage was 10 ft higher. The peak at South Fork Shenandoah River near Lynnwood, 95,100 $ft^3/s$, was 19 percent greater than the previous maximum, and the stage was 2.2 ft higher, from records since 1930.

Discharge hydrographs for the flood at Middle River near Grottoes and at North Fork Shenandoah River at Mount Jackson are shown in figures 26 and 27, and corresponding discharge data are given in tables 11 and 12.

Flood damage in Virginia was extremely severe. Monetarily, Virginia's losses were the largest by far for any flood in the history of the State, including Hurricanes Camille and Agnes. Virginia's losses even exceeded those estimated for West Virginia for this flood, no doubt because more populated and otherwise developed areas were on the flood plains of the most severely flooded rivers in Virginia. The metropolitan areas of Richmond and Lynchburg along the James River, and Roanoke and Salem along the Roanoke River all sustained particularly heavy damage with flood stages being the worst ever recorded in the Roanoke, Salem, and Lynchburg areas.

A total of 22 lives were lost in Virginia and damage was estimated at $753 million, including $19 million tide-related damage (Federal Emergency Management Agency, 1985b). The disaster-area declaration by the Federal Government included 40 counties and 12 independent cities.

Damage to the Roanoke-Salem region alone was estimated at $440 million. Damage to one manufacturing facility exceeded $20 million, according to a Roanoke-based newspaper. Many people in Roanoke were rescued from rooftops by boats and helicopters. Residents of one apartment complex in Salem were rescued by boat from third-floor apartments.

In Lynchburg, where the previous maximum stage known on the James River was exceeded by approximately 7 ft, the damage also was especially severe. For example, an estimated $8 million in tobacco stored in warehouses along the river was destroyed.

The damage in Virginia no doubt would have been even worse if not for two flood-control projects in the affected region. According to the U.S. Army Corps of Engineers (Federal Emergency Management Agency, 1985b), Lake Moomaw functioned to prevent approximately $70 million additional flood damage in the James River basin. Also, Philpott Lake was credited with saving an estimated $1 million in damage along the Smith River in the Roanoke River basin.


Figure 19.-- Williamson Road in Boxley Hills section, Roanoke, Va. metropolitan area. (Photograph by Bob Phillips, Roanoke Times and World News.)


Figure 20.-- Rescue operation on East Main Street, Salem, Va. (Photograph by Wayne Scarberry, Roanoke Times and World News.)

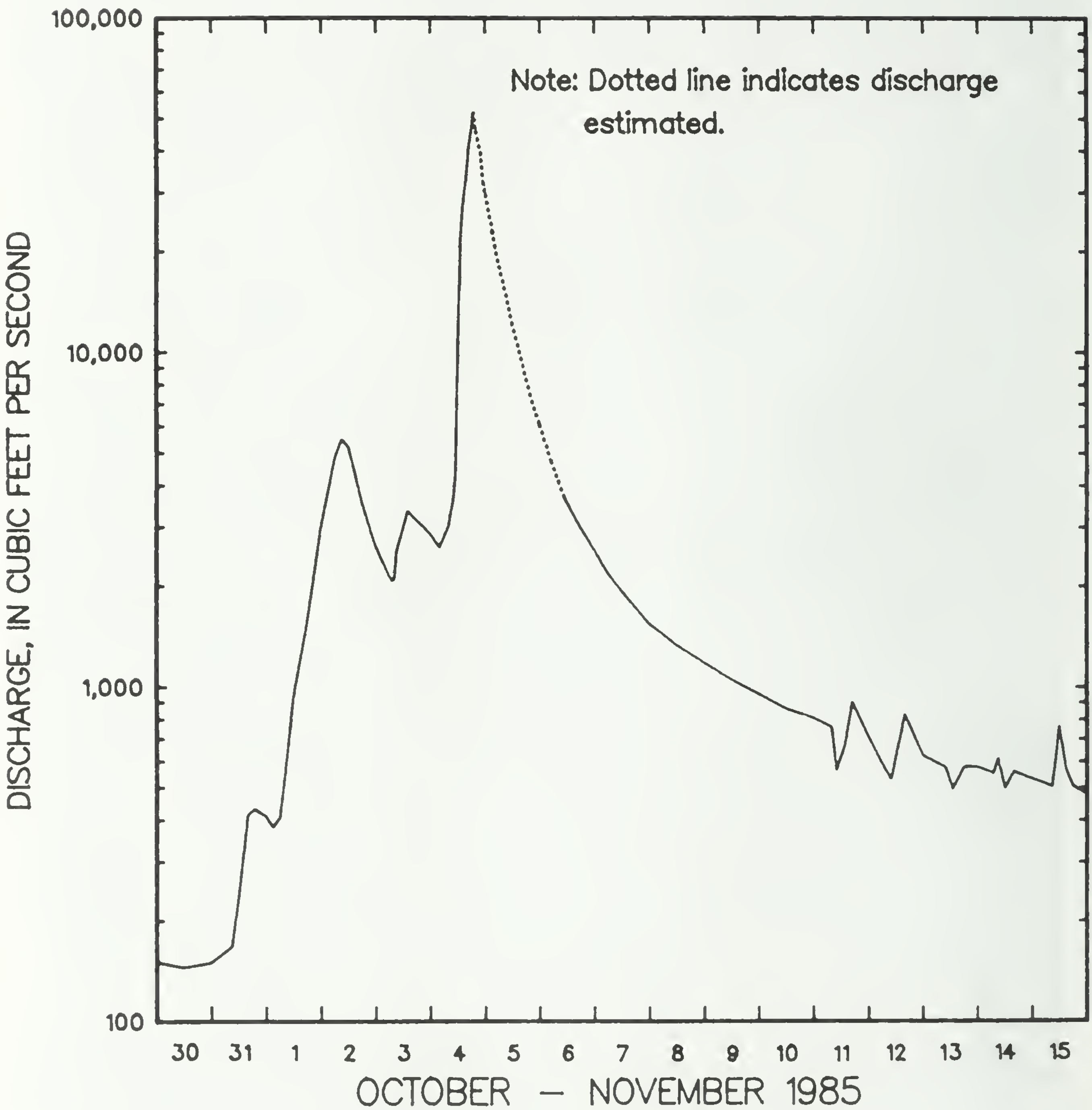



Figure 21.-- Discharge at gaging station Roanoke River at Niagara, Va. (Site No. 120), October 30 - November 15, 1985.

Table 7.--Gage height and discharge for flood of November 1985 at gaging station Roanoke River at Niagara, Va. (Site No. 120)

[ft = feet; $ft^3/s$ = cubic feet per second; dash indicates that gage height was not determined]

| Date | Time | Gage height (ft) | Discharge ($ft^3/s$) | Date | Time | Gage height (ft) | Discharge ($ft^3/s$) |
|---|---|---|---|---|---|---|---|
| October 30---------- | 0100 | 1.72 | 150 | November 5---------- | 0300 | - | [a]22,900 |
| | 1200 | 1.69 | 145 | | 0700 | - | [a]17,200 |
| | 2400 | 1.72 | 150 | | 1200 | - | [a]12,200 |
| October 31---------- | 0900 | 1.82 | 168 | | 1900 | - | [a]7,870 |
| | 1200 | 2.15 | 237 | | 2400 | - | [a]6,060 |
| | 1600 | 2.81 | 417 | November 6---------- | 0500 | - | [a]4,720 |
| | 1900 | 2.86 | 433 | | 1100 | 7.85 | 3,660 |
| | 2400 | 2.79 | 411 | | 1700 | 7.28 | 3,060 |
| November 1---------- | 0300 | 2.69 | 381 | | 2400 | 6.74 | 2,550 |
| | 0600 | 2.78 | 408 | November 7---------- | 0600 | 6.29 | 2,170 |
| | 1200 | 4.14 | 931 | | 1200 | 5.97 | 1,920 |
| | 1800 | 5.27 | 1,560 | | 2400 | 5.43 | 1,540 |
| | 2400 | 7.21 | 3,040 | November 8---------- | 1200 | 5.09 | 1,330 |
| November 2---------- | 0600 | 8.85 | 4,840 | | 2400 | 4.83 | 1,180 |
| | 0900 | 9.36 | 5,510 | November 9---------- | 1200 | 4.57 | 1,050 |
| | 1200 | 9.14 | 5,210 | | 2400 | 4.38 | 952 |
| | 1800 | 7.71 | 3,540 | November 10--------- | 1200 | 4.18 | 859 |
| | 2400 | 6.71 | 2,610 | | 2400 | 4.07 | 810 |
| November 3---------- | 0700 | 6.01 | 2,070 | November 11--------- | 0800 | 3.95 | 759 |
| | 0800 | 6.05 | 2,100 | | 1000 | 3.45 | 564 |
| | 0900 | 6.68 | 2,580 | | 1400 | 3.76 | 681 |
| | 1400 | 7.55 | 3,370 | | 1700 | 4.28 | 905 |
| | 2400 | 7.01 | 2,860 | | 2400 | 3.83 | 709 |
| November 4---------- | 0400 | 6.72 | 2,610 | November 12--------- | 1000 | 3.35 | 529 |
| | 0800 | 7.21 | 3,040 | | 1600 | 4.12 | 832 |
| | 1000 | 7.83 | 3,660 | | 2400 | 3.61 | 623 |
| | 1100 | 8.50 | 4,410 | November 13--------- | 1000 | 3.48 | 575 |
| | 1200 | 11.80 | 9,520 | | 1300 | 3.25 | 495 |
| | 1300 | 16.58 | 21,400 | | 1800 | 3.49 | 578 |
| | 1400 | 18.36 | 26,800 | | 2400 | 3.49 | 578 |
| | 1600 | 20.78 | 34,800 | November 14--------- | 0700 | 3.42 | 553 |
| | 1700 | 22.81 | 42,200 | | 0900 | 3.59 | 615 |
| | 1800 | 23.96 | 46,700 | | 1200 | 3.26 | 498 |
| | [a]1900 | 25.30 | 52,300 | | 1600 | 3.44 | 560 |
| | 2000 | - | [a]45,700 | | 2400 | 3.36 | 532 |
| | 2200 | - | [a]39,500 | November 15--------- | 0900 | 3.28 | 505 |
| | 2300 | - | [a]32,100 | | 1200 | 3.97 | 767 |
| | 2400 | - | [a]29,500 | | 1500 | 3.45 | 564 |
| | | | | | 1800 | 3.28 | 505 |
| | | | | | 2400 | 3.20 | 478 |

[a] Estimated.

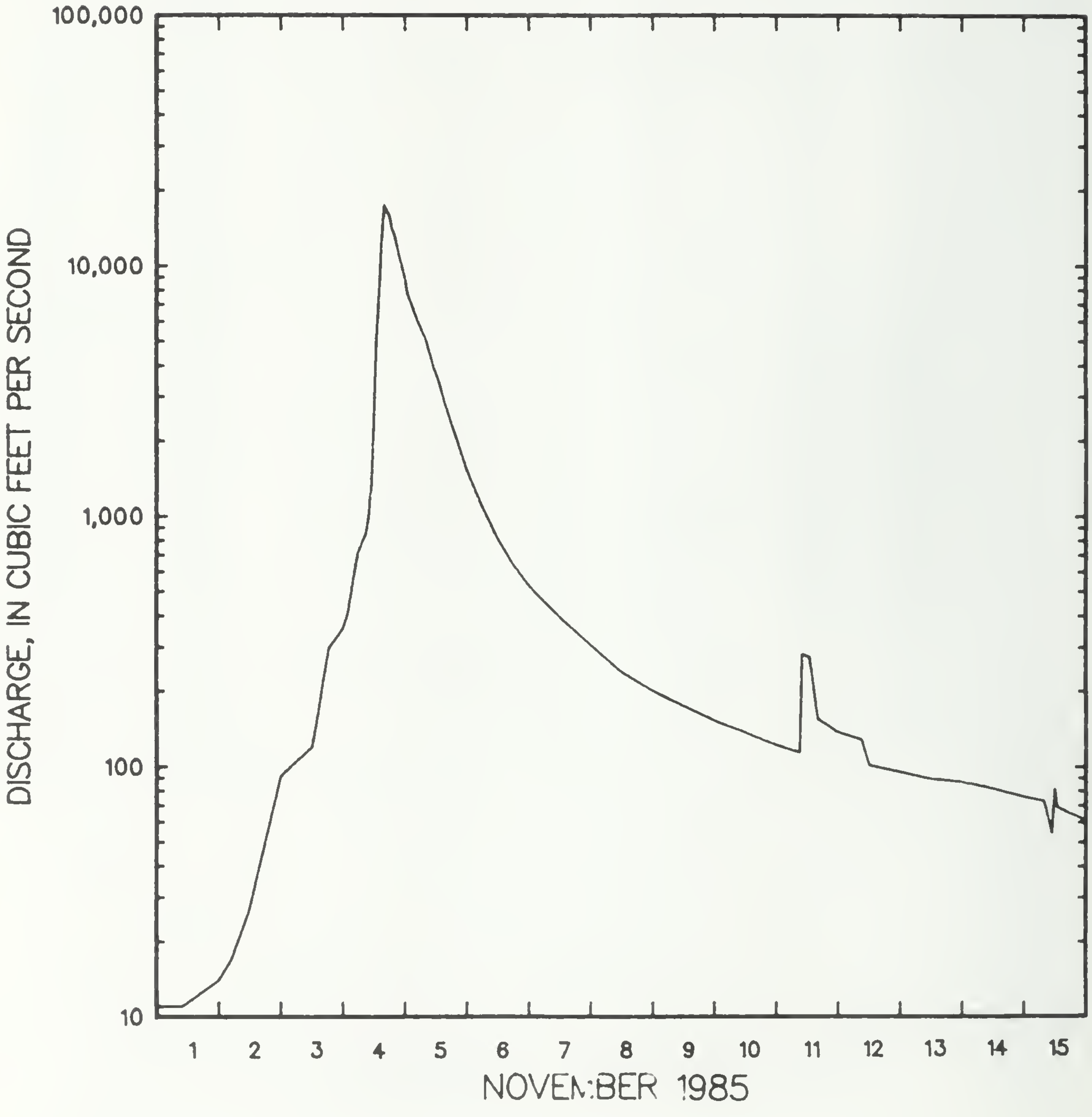



Figure 22.-- Discharge at gaging station Back Creek near Sunrise, Va. (Site No. 60), November 1-15, 1985.

Table 8.--Gage height and discharge for flood of November 1985 at gaging station Back Creek near Sunrise, Va. (Site No. 60)

[ft = feet; $ft^3/s$ = cubic feet per second]

| Date | Time | Gage height (ft) | Discharge ($ft^3/s$) |
|---|---|---|---|
| November 1---------- | 0100 | 0.50 | 11 |
| | 1000 | 0.50 | 11 |
| | 2400 | 0.58 | 14 |
| November 2---------- | 0500 | 0.62 | 17 |
| | 1200 | 0.78 | 27 |
| | 2400 | 1.31 | 92 |
| November 3---------- | 1200 | 1.46 | 120 |
| | 1900 | 2.20 | 301 |
| | 2400 | 2.39 | 355 |
| November 4---------- | 0200 | 2.56 | 407 |
| | 0600 | 3.32 | 731 |
| | 0900 | 3.56 | 857 |
| | 1000 | 3.77 | 977 |
| | 1100 | 4.26 | 1,310 |
| | 1200 | 5.30 | 2,470 |
| | 1300 | 6.66 | 5,050 |
| | 1400 | 7.73 | 7,970 |
| | 1500 | 9.15 | 13,300 |
| | 1600 | [a]10.00 | 17,500 |
| | 1700 | 9.79 | 16,400 |
| | 1800 | 9.67 | 15,800 |
| | 1900 | 9.28 | 13,900 |
| | 2000 | 9.14 | 13,300 |
| | 2200 | 8.51 | 10,700 |
| | 2400 | 8.01 | 8,880 |
| November 5---------- | 0100 | 7.64 | 7,690 |
| | 0500 | 7.02 | 5,950 |
| | 0800 | 6.67 | 5,070 |
| | 1100 | 6.15 | 3,900 |
| | 1300 | 5.93 | 3,470 |
| | 1600 | 5.49 | 2,740 |
| | 2000 | 4.98 | 2,040 |
| | 2400 | 4.58 | 1,520 |
| November 6---------- | 0600 | 4.08 | 1,090 |
| | 1200 | 3.66 | 814 |
| | 1800 | 3.35 | 639 |
| | 2400 | 3.10 | 529 |
| November 7---------- | 1200 | 2.74 | 395 |
| | 2400 | 2.44 | 307 |
| November 8---------- | 1200 | 2.18 | 239 |
| | 2400 | 2.03 | 201 |
| November 9---------- | 1200 | 1.92 | 175 |
| | 2400 | 1.83 | 153 |
| November 10--------- | 1200 | 1.76 | 137 |
| | 2400 | 1.69 | 122 |
| November 11--------- | 0900 | 1.65 | 114 |
| | 1000 | 3.20 | 283 |
| | 1300 | 3.18 | 275 |
| | 1600 | 2.80 | 155 |
| | 2400 | 2.72 | 137 |
| November 12--------- | 0900 | 2.68 | 128 |
| | 1200 | 2.54 | 101 |
| | 2400 | 2.51 | 95 |
| November 13--------- | 1200 | 2.47 | 89 |
| | 2400 | 2.46 | 87 |
| November 14--------- | 1200 | 2.43 | 82 |
| | 2400 | 2.39 | 76 |
| November 15--------- | 0800 | 2.37 | 73 |
| | 1100 | 2.23 | 54 |
| | 1200 | 2.50 | 82 |
| | 1300 | 2.41 | 69 |
| | 2400 | 2.35 | 61 |

[a] Peak stage, 10.01 ft; see table 16.

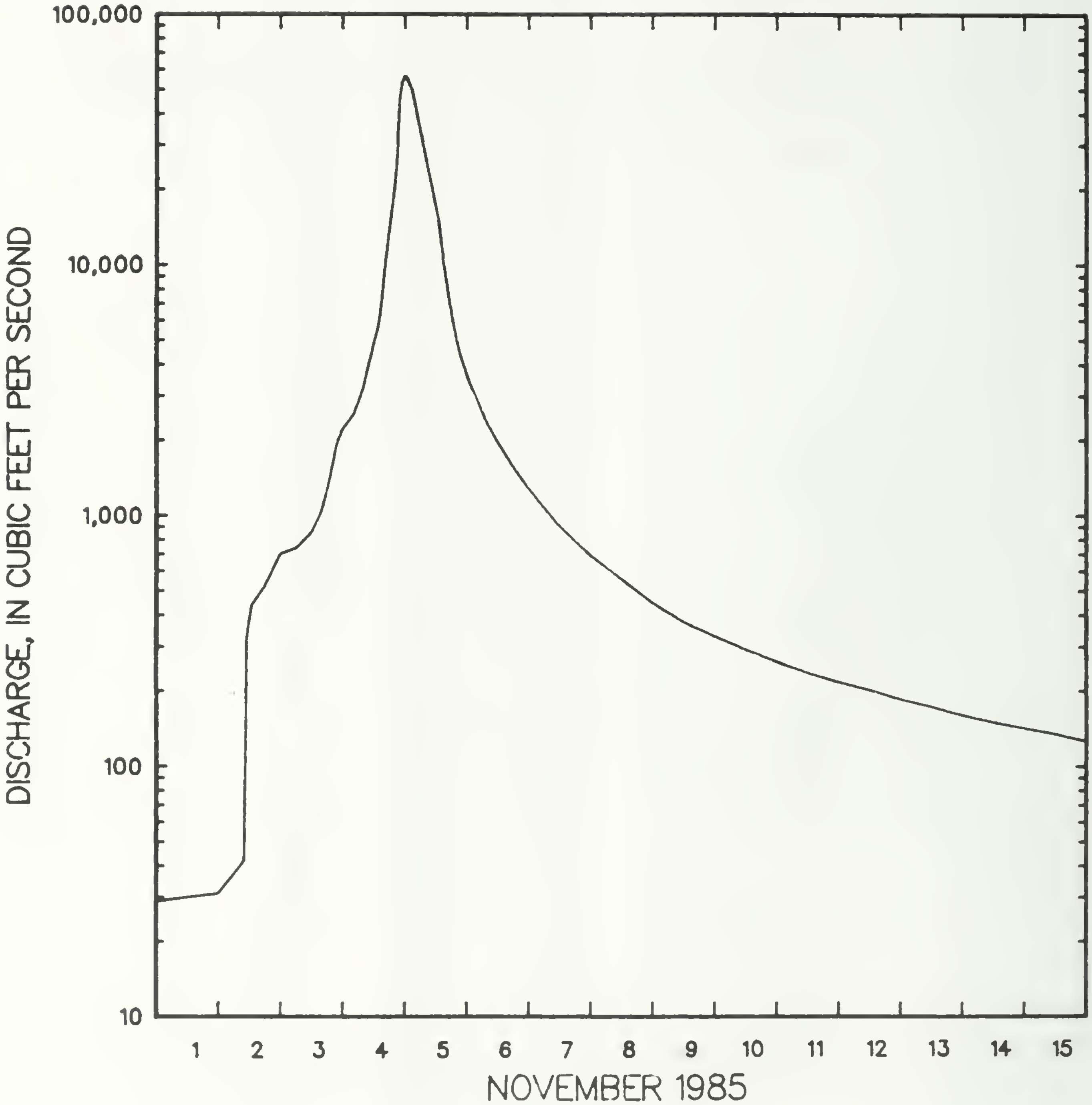



Figure 23.-- Discharge at gaging station Calfpasture River above Mill Creek at Goshen, Va. (Site No. 80), November 1-15, 1985.

Table 9.--Gage height and discharge for flood of November 1985 at gaging station Calfpasture River above Mill Creek at Goshen, Va. (Site No. 80)

[ft = feet; $ft^3/s$ = cubic feet per second]

| Date | Time | Gage height (ft) | Discharge ($ft^3/s$) |
|---|---|---|---|
| November 1---------- | 0100 | 1.93 | 29 |
| | 1200 | 1.94 | 30 |
| | 2400 | 1.95 | 31 |
| November 2---------- | 1000 | 2.02 | 42 |
| | 1100 | 3.01 | 325 |
| | 1300 | 3.22 | 442 |
| | 1800 | 3.35 | 523 |
| | 2400 | 3.63 | 706 |
| November 3---------- | 0600 | 3.68 | 741 |
| | 1200 | 3.84 | 855 |
| | 1600 | 4.09 | 1,050 |
| | 1800 | 4.35 | 1,270 |
| | 2200 | 5.16 | 1,980 |
| | 2400 | 5.43 | 2,230 |
| November 4---------- | 0400 | 5.72 | 2,520 |
| | 0800 | 6.44 | 3,240 |
| | 1400 | 8.20 | 5,790 |
| | 1500 | 8.85 | 7,030 |
| | 1600 | 9.88 | 9,160 |
| | 1800 | 11.54 | 14,200 |
| | 2000 | 13.10 | 20,200 |
| | 2100 | 14.58 | 26,900 |
| | 2200 | 18.36 | 46,000 |
| | 2300 | 19.82 | 54,000 |
| | 2400 | 20.23 | 56,300 |
| November 5---------- | 0100 | 20.09 | 55,500 |
| | 0300 | 18.92 | 49,100 |
| | 0600 | 16.01 | 33,900 |
| | 0800 | 14.48 | 26,500 |
| | 1300 | 11.77 | 15,000 |
| | 1500 | 10.27 | 10,100 |
| | 1700 | 9.04 | 7,390 |
| | 1900 | 8.14 | 5,680 |
| | 2100 | 7.49 | 4,530 |
| | 2400 | 6.78 | 3,620 |
| November 6---------- | 0300 | 6.22 | 3,020 |
| | 0600 | 5.77 | 2,570 |
| | 0900 | 5.41 | 2,210 |
| | 1200 | 5.12 | 1,950 |
| | 1800 | 4.68 | 1,550 |
| | 2400 | 4.35 | 1,270 |
| November 7---------- | 1200 | 3.90 | 900 |
| | 2400 | 3.61 | 692 |
| November 8---------- | 1200 | 3.40 | 555 |
| | 2400 | 3.23 | 448 |
| November 9---------- | 1200 | 3.11 | 376 |
| | 2400 | 3.02 | 330 |
| November 10--------- | 1200 | 2.94 | 293 |
| | 2400 | 2.87 | 262 |
| November 11--------- | 1200 | 2.81 | 236 |
| | 2400 | 2.76 | 217 |
| November 12--------- | 1200 | 2.72 | 202 |
| | 2400 | 2.67 | 185 |
| November 13--------- | 1200 | 2.63 | 173 |
| | 2400 | 2.59 | 160 |
| November 14--------- | 1200 | 2.55 | 150 |
| | 2400 | 2.52 | 142 |
| November 15--------- | 1200 | 2.49 | 135 |
| | 2400 | 2.45 | 126 |

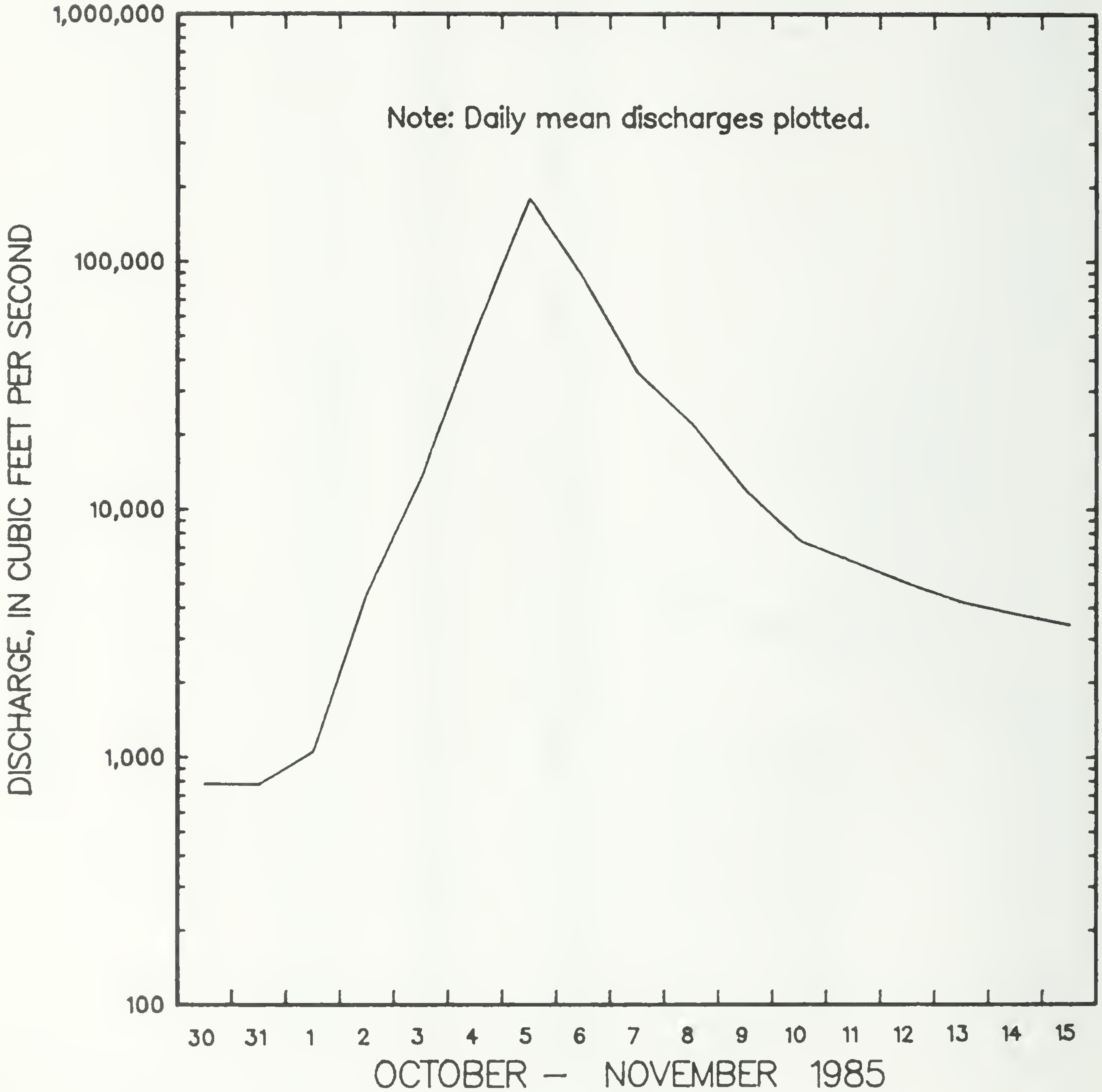



Figure 24.-- Discharge at gaging station James River at Holcombs Rock, Va. (Site No. 86), October 30 - November 15, 1985.

Table 10.--Daily mean discharge for flood of November 1985 at gaging station James River at Holcombs Rock, Va. (Site No. 86)

[ft = feet; $ft^3/s$ = cubic feet per second]

| Date | Equivalent gage height (ft) | Mean Discharge ($ft^3/s$) |
|---|---|---|
| October 30--------- | 4.17 | 708 |
| 31--------- | 4.16 | 776 |
| November 1--------- | 4.45 | 1,050 |
| 2--------- | 6.99 | 4,590 |
| 3--------- | 10.79 | 13,500 |
| 4--------- | 20.72 | 51,600 |
| November 5--------- | [a]39.17 | [a]180,000 |
| 6--------- | 26.55 | 86,000 |
| 7--------- | 17.21 | 35,800 |
| 8--------- | 13.65 | 22,300 |
| 9--------- | 10.27 | 12,000 |
| November 10--------- | 8.48 | 7,510 |
| 11--------- | 7.83 | 6,160 |
| 12--------- | 7.24 | 5,040 |
| 13--------- | 6.78 | 4,240 |
| 14--------- | 6.50 | 3,790 |
| November 15--------- | 6.27 | 3,430 |

[a] Peak discharge (instantaneous maximum) occurred November 5, 207,000 $ft^3/s$; gage height = 42.15 ft.

Figure 25.-- Confluence of Shenandoah and Potomac Rivers at Harpers Ferry, W. Va. (Photograph by Larry Morrris, the Washington Post, Washington, D.C.)

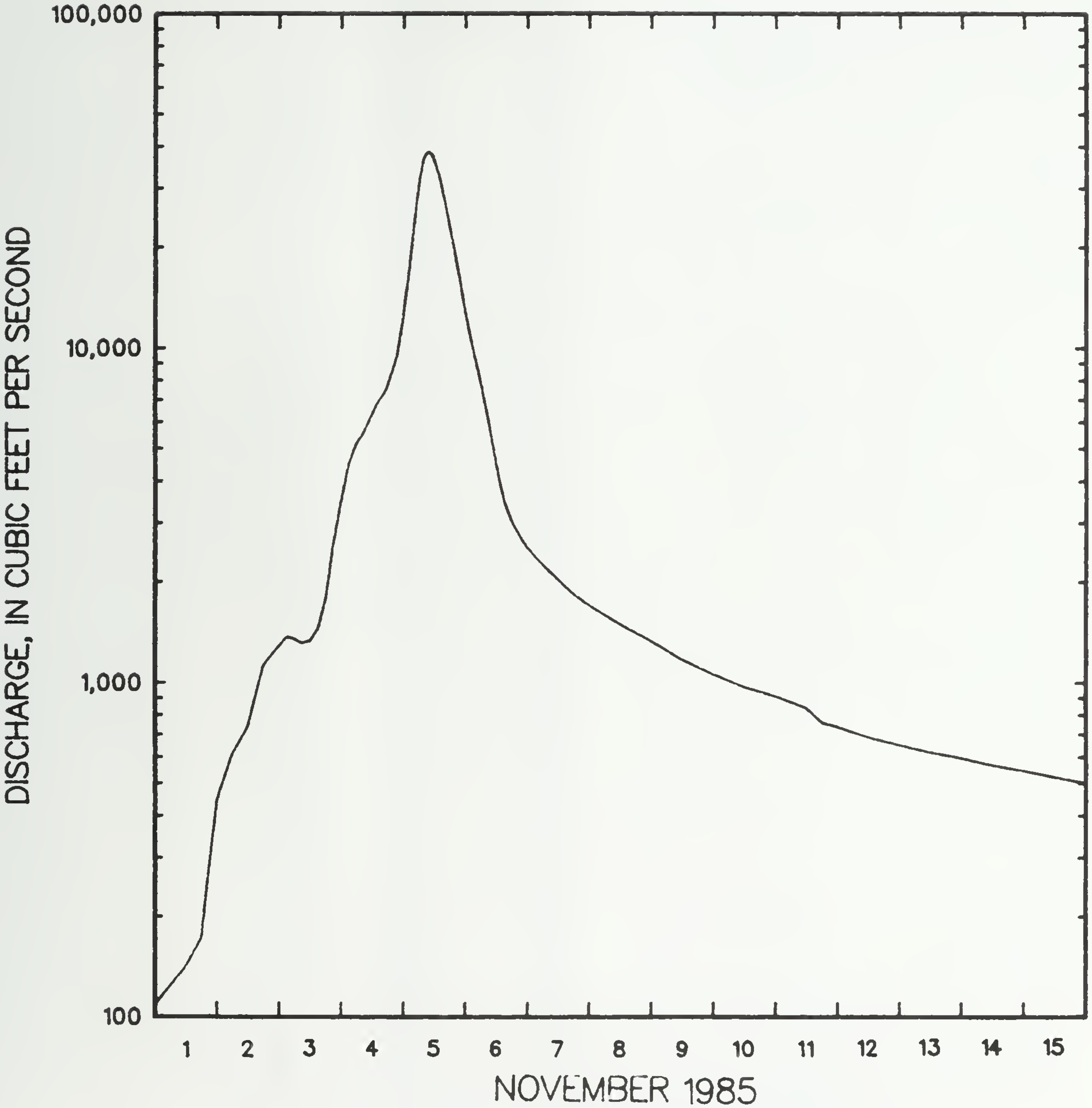



Figure 26.-- Discharge at gaging station Middle River near Grottoes, Va. (Site No. 30), November 1-15, 1985.

Table 11.--Gage height and discharge for flood of November 1985 at gaging station Middle River near Grottoes, Va. (Site No. 30)

[ft = feet; $ft^3/s$ = cubic feet per second]

| Date | Time | Gage height (ft) | Discharge ($ft^3/s$) |
|---|---|---|---|
| November 1---------- | 0100 | 3.53 | 111 |
| | 1200 | 3.69 | 142 |
| | 1800 | 3.82 | 173 |
| | 2400 | 4.85 | 450 |
| November 2---------- | 0600 | 5.38 | 617 |
| | 1200 | 5.72 | 739 |
| | 1800 | 6.72 | 1,130 |
| | 2400 | 7.10 | 1,290 |
| November 3---------- | 0300 | 7.28 | 1,370 |
| | 0600 | 7.23 | 1,350 |
| | 0900 | 7.16 | 1,310 |
| | 1200 | 7.20 | 1,330 |
| | 1500 | 7.43 | 1,450 |
| | 1800 | 8.05 | 1,780 |
| | 2100 | 9.41 | 2,620 |
| | 2400 | 10.76 | 3,540 |
| November 4---------- | 0300 | 12.05 | 4,570 |
| | 0600 | 12.77 | 5,210 |
| | 0900 | 13.22 | 5,630 |
| | 1200 | 13.94 | 6,350 |
| | 1400 | 14.45 | 6,870 |
| | 1700 | 14.94 | 7,400 |
| | 1800 | 15.26 | 7,760 |
| | 2100 | 16.46 | 9,160 |
| | 2200 | 17.09 | 9,950 |
| | 2400 | 19.14 | 12,700 |
| November 5---------- | 0200 | 21.90 | 16,800 |
| | 0400 | 25.74 | 23,300 |
| | 0600 | 29.93 | 31,500 |
| | 0700 | 31.51 | 34,900 |
| | 0800 | 32.58 | 37,300 |
| | 0900 | 33.01 | 38,300 |
| | 1000 | [a]33.03 | [b]38,400 |
| | 1100 | 32.77 | 37,700 |
| | 1200 | 32.07 | 36,100 |
| | 1400 | 30.17 | 32,000 |
| | 1600 | 27.78 | 27,200 |
| | 1800 | 25.28 | 22,500 |
| | 2100 | 21.86 | 16,800 |
| | 2400 | 19.15 | 12,700 |
| November 6---------- | 0300 | 17.07 | 9,920 |
| | 0600 | 15.28 | 7,780 |
| | 0900 | 13.54 | 5,950 |
| | 1200 | 11.82 | 4,410 |
| | 1500 | 10.54 | 3,450 |
| | 1800 | 9.84 | 3,000 |
| | 2100 | 9.39 | 2,730 |
| | 2400 | 9.03 | 2,520 |
| November 7---------- | 0600 | 8.53 | 2,240 |
| | 1200 | 8.15 | 2,030 |
| | 1800 | 7.79 | 1,830 |
| | 2400 | 7.55 | 1,700 |
| November 8---------- | 1200 | 7.15 | 1,490 |
| | 2400 | 6.83 | 1,330 |
| November 9---------- | 1200 | 6.51 | 1,170 |
| | 2400 | 6.29 | 1,060 |
| November 10--------- | 1200 | 6.10 | 971 |
| | 2400 | 5.97 | 912 |
| November 11--------- | 1200 | 5.81 | 840 |
| | 1800 | 5.62 | 759 |
| | 2400 | 5.57 | 739 |
| November 12--------- | 1200 | 5.44 | 687 |
| | 2400 | 5.35 | 651 |
| November 13--------- | 1200 | 5.27 | 619 |
| | 2400 | 5.21 | 595 |
| November 14--------- | 1200 | 5.13 | 566 |
| | 2400 | 5.07 | 545 |
| November 15--------- | 1200 | 5.00 | 522 |
| | 2400 | 4.93 | 501 |

[a] Peak stage, 33.09 ft (probably between 0900 and 1000 hours); see table 16.

[b] Peak discharge, 38,500 $ft^3/s$; see table 16.

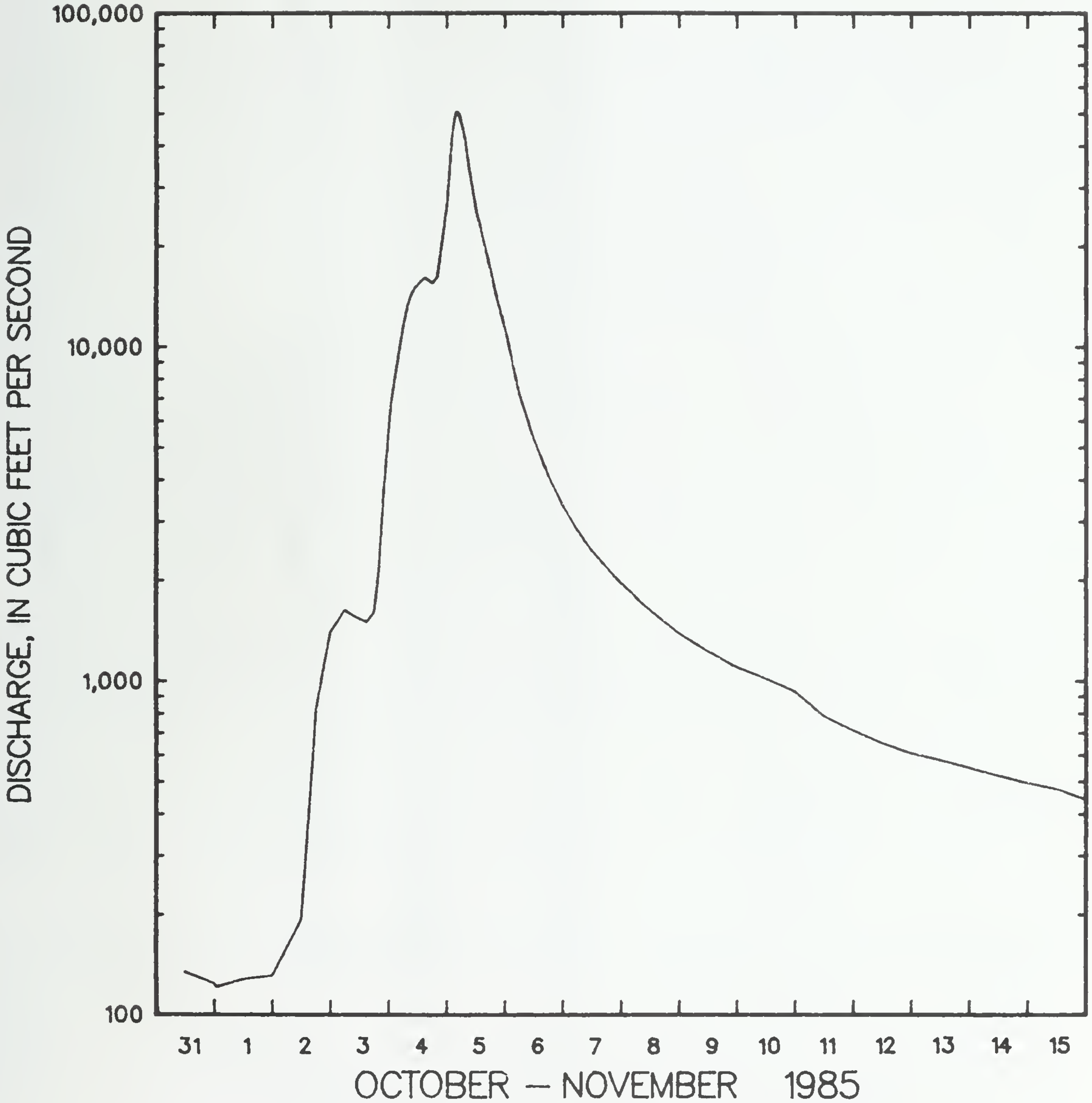



Figure 27.-- Discharge at gaging station North Fork Shenandoah River at Mount Jackson, Va. (Site No. 42), October 31 - November 15, 1985.

Table 12.--Gage height and discharge for flood of November 1985 at gaging station North Fork Shenandoah River at Mount Jackson, Va. (Site No. 42)

[ft = feet; $ft^3/s$ = cubic feet per second]

| Date | Time | Gage height (ft) | Discharge ($ft^3/s$) |
|---|---|---|---|
| October 31---------- | 1200 | 2.67 | 134 |
| | 2400 | 2.64 | 124 |
| November 1---------- | 0100 | 2.63 | 121 |
| | 1200 | 2.65 | 128 |
| | 2400 | 2.66 | 131 |
| November 2---------- | 1200 | 2.85 | 194 |
| | 1800 | 4.14 | 824 |
| | 2400 | 5.06 | 1,410 |
| November 3---------- | 0600 | 5.35 | 1,630 |
| | 1200 | 5.22 | 1,530 |
| | 1500 | 5.18 | 1,500 |
| | 1800 | 5.31 | 1,600 |
| | 2000 | 6.00 | 2,150 |
| | 2200 | 7.55 | 3,740 |
| | 2400 | 9.03 | 5,680 |
| November 4---------- | 0100 | 9.79 | 6,780 |
| | 0300 | 10.81 | 8,520 |
| | 0600 | 12.35 | 11,600 |
| | 0800 | 13.24 | 13,600 |
| | 1000 | 13.77 | 14,800 |
| | 1200 | 14.07 | 15,500 |
| | 1500 | 14.30 | 16,200 |
| | 1800 | 14.06 | 15,500 |
| | 2000 | 14.30 | 16,200 |
| | 2400 | 16.13 | 26,700 |
| November 5---------- | 0200 | 17.39 | 41,800 |
| | 0300 | 17.66 | 47,500 |
| | 0400 | 17.79 | 50,800 |
| | 0500 | 17.76 | 50,000 |
| | 0700 | 17.50 | 44,000 |
| | 0900 | 16.95 | 34,500 |
| | 1200 | 15.98 | 25,500 |
| | 1400 | 15.54 | 22,400 |
| | 1600 | 15.07 | 19,600 |
| | 2000 | 13.71 | 14,600 |
| | 2400 | 12.22 | 11,300 |
| November 6---------- | 0300 | 11.08 | 9,060 |
| | 0600 | 10.11 | 7,300 |
| | 1200 | 8.76 | 5,300 |
| | 1800 | 7.86 | 4,110 |
| | 2400 | 7.21 | 3,350 |
| November 7---------- | 0600 | 6.72 | 2,830 |
| | 1200 | 6.33 | 2,450 |
| | 2400 | 5.76 | 1,960 |
| November 8---------- | 1200 | 5.35 | 1,630 |
| | 2400 | 5.03 | 1,390 |
| November 9---------- | 1200 | 4.80 | 1,230 |
| | 2400 | 4.60 | 1,100 |
| November 10--------- | 1200 | 4.46 | 1,020 |
| | 2400 | 4.32 | 932 |
| November 11--------- | 1200 | 4.07 | 784 |
| | 2400 | 3.94 | 712 |
| November 12--------- | 1200 | 3.83 | 652 |
| | 2400 | 3.75 | 608 |
| November 13--------- | 1200 | 3.70 | 580 |
| | 2400 | 3.64 | 550 |
| November 14--------- | 1200 | 3.58 | 520 |
| | 2400 | 3.53 | 495 |
| November 15--------- | 1200 | 3.49 | 475 |
| | 2400 | 3.42 | 442 |

## Pennsylvania

The November 1985 storm caused severe flooding in Pennsylvania, but flooding was much more localized than in West Virginia and Virginia. Record-breaking floods in Pennsylvania occurred only in the Monongahela River basin and only on the main stem above the confluence with the Youghiogheny River. However, the flooding along the Monongahela River was severe and the damage was very extensive. Many towns along the main stem were flooded from Point Marion (fig. 28), located just downstream from the West Virginia State line, to Pittsburgh (fig. 29).

At two gaging stations, the peak discharges set new records for magnitude: the peak flow of 220,000 $ft^3/s$ at the Monongahela River at Greensboro was more than 60 percent greater than the previous maximum (134,000 $ft^3/s$) from records since 1938, and the peak stage was more than 9 ft higher. The peak discharge farther downstream on the Monongahela River at Elizabeth, 178,000 $ft^3/s$, obviously was attenuated but was still 12 percent greater than the previous maximum (158,000 $ft^3/s$), from records since 1933. The recurrence interval of the flood peak at the downstream station was 85 years, and at the upstream station (at Greensboro) it was over 100 years. At a third station, Monongahela River at Braddock, still farther downstream (below the confluence with the Youghiogheny River), the peak discharge was 190,000 $ft^3/s$ (not a record) with a recurrence interval of 25 years. Flooding on the Youghiogheny River in Pennsylvania was minimal, largely because of flood-control storage provided by Youghiogheny River Lake which crosses the Pennsylvania-Maryland State line. Discharge hydrographs of the flood on the Monongahela River at Greensboro (daily-discharge) and at Elizabeth (instantaneous-discharge) are shown in figures 30 and 31, respectively, and discharge values are given in tables 13 and 14.

Flood damage in Pennsylvania was extremely heavy along the Monongahela River, but was essentially limited to that river basin. There was one flood-related fatality in the State and damage was estimated at $83 million (Federal Emergency Management Agency, 1985a). A total of six counties in Pennsylvania were declared disaster areas by the Federal Government.

Nearly 3,000 homes in the disaster-declared counties were damaged, with major damage to over 900 of them. Damage to the facilities of one of the steel companies along the river was estimated to be $3 million.

Along the Monongahela River there is a network of nine locks and dams that normally make it navigable throughout its length. Commercial barge traffic is extensive and important to the economy. During the flood, 62 barges broke loose from their moorings. They smashed into bridges, got caught in dams and locks, and some sank, causing extremely hazardous conditions. Repairs to damaged facilities, clearing the channel, and the loss of commerce were estimated to be as much as $15 million.

Flood-control projects at three locations upstream in the Monongahela River basin, two in West Virginia and one crossing the Maryland-Pennsylvania State line, no doubt materially reduced the flooding on the

Figure 28.-- Monongahela River at bridge on State highway 88, Point Marion, Pa. (Photograph by Ron Rittenhouse, Dominion Post, Morgantown, W. Va.)

Figure 29.-- Pittsburgh's Three River Stadium on Ohio River at confluence of Monongahela and Allegheny Rivers, Pa. (Photograph by Dale Gleason, The Pittsburgh Press).

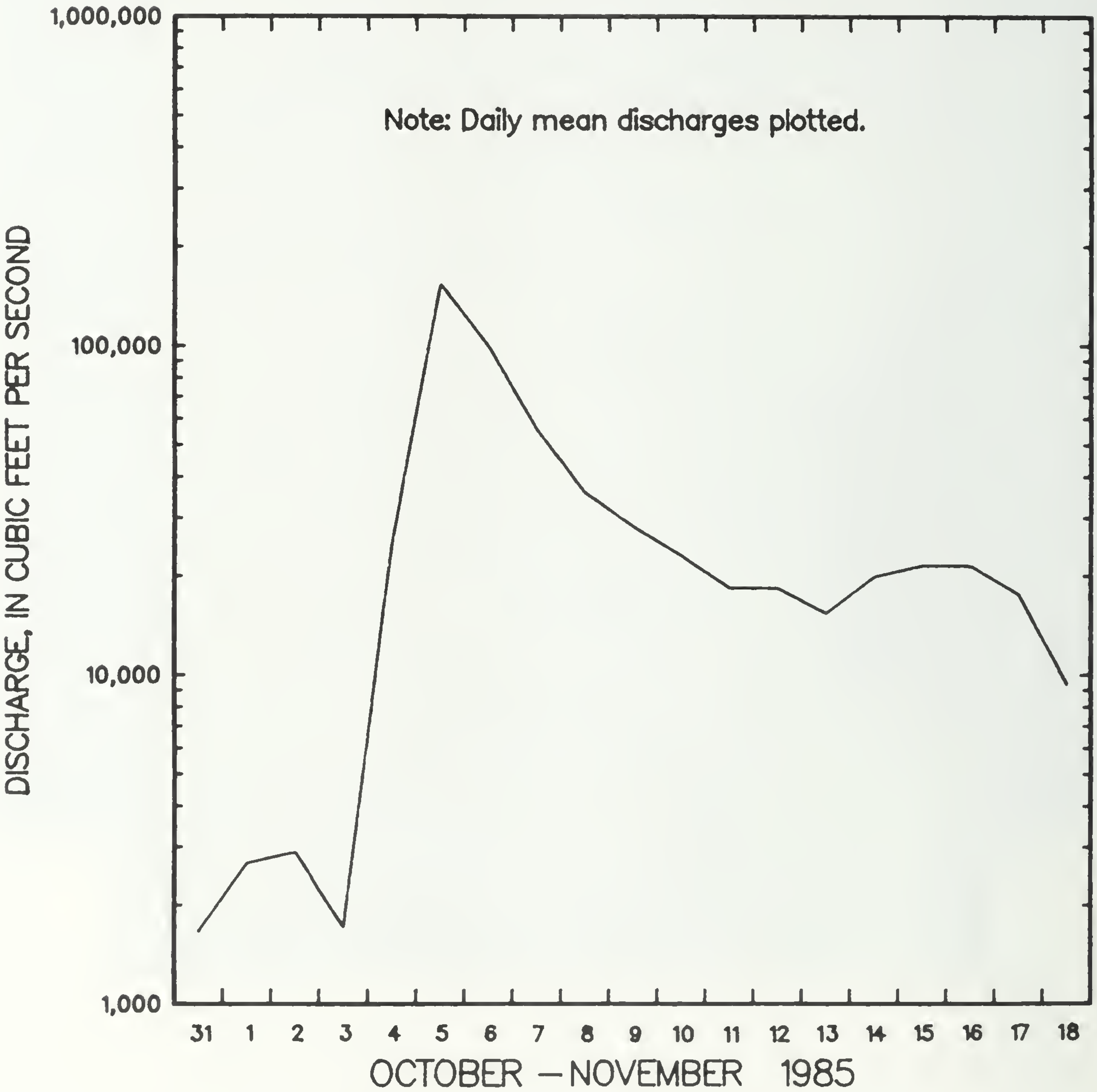



Figure 30.-- Discharge at gaging station Monongahela River at Greensboro, Pa. (Site No. 150), October 31 - November 18, 1985.

Table 13.--Daily mean discharge for flood of November 1985 at gaging station Monongahela River at Greensboro, Pa. (Site No. 150)

[ft = feet; $ft^3/s$ = cubic feet per second]

| Date | Equivalent gage height (ft) | Mean Discharge ($ft^3/s$) |
|---|---|---|
| October 31---------- | 11.36 | 1,660 |
| November 1---------- | 11.76 | 2,680 |
| 2---------- | 11.83 | 2,900 |
| 3---------- | 11.38 | 1,710 |
| 4---------- | 15.42 | 25,500 |
| November 5---------- | [a]33.16 | [a]154,000 |
| 6---------- | 23.14 | 100,000 |
| 7---------- | 18.24 | 55,600 |
| 8---------- | 16.54 | 35,900 |
| 9---------- | 15.74 | 28,300 |
| November 10--------- | 15.14 | 23,100 |
| 11--------- | 14.55 | 18,400 |
| 12--------- | 14.55 | 18,400 |
| 13--------- | 14.14 | 15,400 |
| 14--------- | 14.74 | 19,900 |
| November 15--------- | 14.94 | 21,500 |
| 16--------- | 14.94 | 21,500 |
| 17--------- | 14.44 | 17,600 |
| 18--------- | 13.24 | 9,440 |

[a] Peak discharge (instantaneous maximum) occurred November 5, 220,000 $ft^3/s$; gage height = 39.39 ft.

main stem in Pennsylvania. Tygart Lake on the Tygart Valley River and Stonewall Jackson Lake on the West Fork River both functioned to prevent even more extensive damage in the upper Monongahela River valley. Youghiogheny River Lake on the Youghiogheny River effectively reduced the flooding on the lower Youghiogheny and lower Monongahela River valleys.

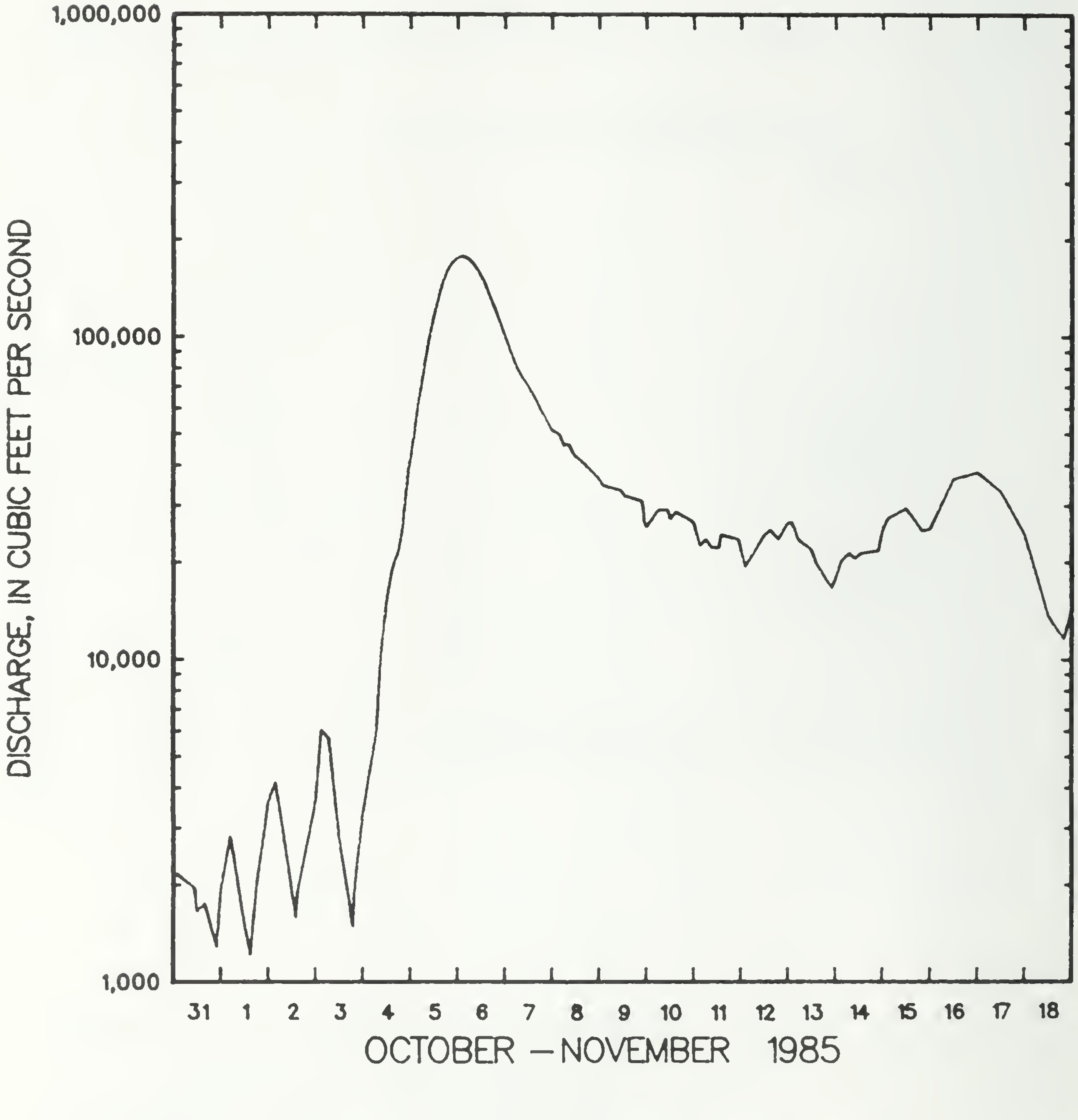



Figure 31.-- Discharge at gaging station Monongahela River at Elizabeth, Pa. (Site No. 153), October 31 - November 18, 1985.

Table 14.--Gage height and discharge for flood of November 1985 at gaging station Monongahela River at Elizabeth, Pa. (Site No. 153)

[ft = feet; $ft^3/s$ = cubic feet per second]

| Date | Time | Gage height (ft) | Discharge ($ft^3/s$) |
|---|---|---|---|
| October 31---------- | 0200 | 1.98 | 2,160 |
| | 1100 | 1.90 | 1,950 |
| | 1200 | 1.78 | 1,650 |
| | 1600 | 1.82 | 1,750 |
| | 2200 | 1.63 | 1,280 |
| | 2400 | 1.90 | 1,950 |
| November 1---------- | 0500 | 2.21 | 2,830 |
| | 1200 | 1.72 | 1,505 |
| | 1500 | 1.60 | 1,210 |
| | 1800 | 1.92 | 2,010 |
| | 2400 | 2.46 | 3,610 |
| November 2---------- | 0400 | 2.62 | 4,170 |
| | 1400 | 1.75 | 1,580 |
| | 1500 | 1.89 | 1,930 |
| | 2400 | 2.46 | 3,610 |
| November 3---------- | 0300 | 3.10 | 6,070 |
| | 0700 | 3.02 | 5,690 |
| | 1200 | 2.18 | 2,740 |
| | 1900 | 1.71 | 1,480 |
| | 2000 | 1.91 | 1,980 |
| | 2400 | 2.37 | 3,320 |
| November 4---------- | 0700 | 3.08 | 5,980 |
| | 0900 | 3.90 | 10,400 |
| | 1200 | 4.67 | 15,400 |
| | 1500 | 5.22 | 19,400 |
| | 1800 | 5.54 | 21,700 |
| | 2000 | 5.95 | 25,300 |
| | 2300 | 7.40 | 38,400 |
| | 2400 | 7.75 | 41,800 |
| November 5---------- | 0200 | 8.60 | 49,900 |
| | 0400 | 10.00 | 63,000 |
| | 0500 | 10.50 | 67,500 |
| | 0800 | 12.90 | 89,100 |
| | 1100 | 15.20 | 110,000 |
| | 1300 | 16.70 | 123,000 |
| | 1400 | 17.73 | 131,000 |
| | 1600 | 19.52 | 145,300 |
| | 1800 | 21.07 | 158,000 |
| | 2000 | 22.15 | 166,000 |
| | 2200 | 22.89 | 172,000 |
| | 2400 | 23.39 | 176,000 |
| November 6---------- | 0100 | 23.52 | 177,000 |
| | 0200 | 23.60 | 178,000 |
| | 0300 | 23.59 | 178,000 |
| | 0400 | 23.53 | 177,000 |
| | 0500 | 23.34 | 176,000 |
| | 0700 | 22.81 | 172,000 |
| | 1000 | 21.61 | 162,000 |
| | 1200 | 20.56 | 154,000 |
| | 1400 | 19.42 | 146,000 |
| | 1600 | 18.24 | 135,000 |
| | 1800 | 17.06 | 126,000 |
| | 2000 | 15.96 | 117,000 |
| | 2200 | 14.97 | 108,000 |
| | 2400 | 14.06 | 99,700 |
| November 7---------- | 0400 | 12.48 | 85,300 |
| | 0700 | 11.69 | 78,200 |
| | 1200 | 10.78 | 70,000 |
| | 1600 | 10.08 | 63,700 |
| | 2000 | 9.28 | 56,300 |
| | 2400 | 8.75 | 51,300 |
| November 8---------- | 0400 | 8.57 | 49,600 |
| | 0600 | 8.17 | 45,800 |
| | 0700 | 8.24 | 46,500 |
| | 0900 | 8.20 | 46,100 |
| | 1100 | 7.90 | 43,200 |
| | 1800 | 7.53 | 39,600 |
| | 2400 | 7.17 | 36,200 |

Table 14.--Gage height and discharge for flood of November 1985 at gaging station Monongahela River at Elizabeth, Pa. (Site No. 153)--Continued

[ft = feet; $ft^3/s$ = cubic feet per second]

| Date | Time | Gage height (ft) | Discharge ($ft^3/s$) |
|---|---|---|---|
| November 9---------- | 0200 | 6.98 | 34,600 |
| | 1100 | 6.86 | 33,400 |
| | 1300 | 6.71 | 32,100 |
| | 2200 | 6.59 | 31,000 |
| | 2300 | 6.07 | 26,400 |
| | 2400 | 5.99 | 25,700 |
| November 10--------- | 0600 | 6.38 | 29,100 |
| | 1100 | 6.38 | 29,100 |
| | 1200 | 6.17 | 27,200 |
| | 1500 | 6.34 | 28,700 |
| | 2400 | 6.10 | 26,600 |
| November 11--------- | 0300 | 5.63 | 22,500 |
| | 0600 | 5.76 | 23,600 |
| | 0900 | 5.60 | 22,200 |
| | 1300 | 5.60 | 22,200 |
| | 1400 | 5.84 | 24,400 |
| | 2300 | 5.74 | 23,500 |
| | 2400 | 5.55 | 21,800 |
| November 12--------- | 0200 | 5.22 | 19,400 |
| | 1200 | 5.86 | 24,500 |
| | 1500 | 5.95 | 25,300 |
| | 1900 | 5.76 | 23,600 |
| | 2400 | 6.10 | 26,600 |
| November 13--------- | 0200 | 6.10 | 26,600 |
| | 0500 | 5.76 | 23,600 |
| | 1200 | 5.55 | 21,800 |
| | 1400 | 5.30 | 20,000 |
| | 2200 | 4.85 | 16,600 |
| | 2400 | 5.01 | 17,800 |
| November 14--------- | 0300 | 5.34 | 20,300 |
| | 0700 | 5.49 | 21,400 |
| | 1000 | 5.39 | 20,600 |
| | 1300 | 5.50 | 21,400 |
| | 2200 | 5.55 | 21,800 |
| | 2400 | 5.95 | 25,300 |
| November 15--------- | 0300 | 6.20 | 27,500 |
| | 1200 | 6.42 | 29,500 |
| | 2000 | 5.91 | 25,000 |
| | 2400 | 5.96 | 25,400 |
| November 16--------- | 1200 | 7.19 | 36,400 |
| | 2400 | 7.37 | 38,100 |
| November 17--------- | 1200 | 6.84 | 33,200 |
| | 2400 | 5.86 | 24,500 |
| November 18--------- | 1200 | 4.43 | 13,700 |
| | 2000 | 4.10 | 11,600 |
| | 2400 | 4.51 | 14,300 |

## Maryland

Flooding in Maryland was more widespread than in Pennsylvania, but generally less severe. Except for some incidental flooding caused by high tides in the coastal regions, flooding in Maryland was confined mainly to the Potomac River basin. This flooding, however, created some serious problems all the way from the headwaters of the Potomac, on the North Branch, to Washington, D.C. The most serious flooding occurred in the headwaters of the North Branch and on the mainstem Potomac River downstream from confluences with major tributaries from the south which drained the severely flooded regions of West Virginia and Virginia. The major flooding in the headwaters occurred upstream from Bloomington Lake, which was very effective in preventing more severe flooding downstream. Significant flooding did occur in the Youghiogheny River basin in Maryland, but it did not cause widespread damage.

At three gaging stations in the Potomac River basin in Maryland, the peak discharges exceeded 100-year recurrence intervals, and at two of those stations the peaks set new records of magnitude. At the gaging station North Branch Potomac River at Steyer, the peak flow, 11,500 $ft^3/s$, exceeded the previous maximum of 11,300 $ft^3/s$, though barely, from records available since 1956. The peak flow farther downstream at North Branch Potomac River at Kitzmiller, 50,400 $ft^3/s$, exceeded the previous maximum, 33,400 $ft^3/s$ (from records since 1949), by 51 percent. The peaks at both of these sites exceeded 100-year recurrence intervals. The peak discharge at Potomac River at Paw Paw also exceeded the 100-year recurrence interval with a discharge of 235,000 $ft^3/s$, which approached the previous maximum of 240,000 $ft^3/s$ recorded in 1936. The gaging station at Paw Paw is downstream from the confluence of the North Branch and South Branch Potomac River. The flood peak at Paw Paw came primarily from the extreme flooding on the South Branch, in West Virginia, with relatively little contribution from the North Branch. The North Branch peak was effectively attenuated by Savage River Dam and Bloomington Lake downstream from the gaging station at Kitzmiller. A discharge hydrograph for the flood at Potomac River at Paw Paw is shown in figure 32, and daily discharge data are given in table 15.

Only one extraordinary peak was recorded in Maryland in the Youghiogheny River basin. That peak, 11,700 $ft^3/s$, at Youghiogheny River near Oakland, had a recurrence interval of 50 years and was exceeded, but only slightly, by the previous maximum, 11,800 $ft^3/s$, from records since 1941.

Considerable damage occurred in Maryland as a result of the flood of November 1985, particularly along the main stem Potomac River. However, the damage was relatively minor compared to that inflicted on the other three States. One fatality was attributed to the flooding in Maryland, and damage was estimated at $5 million, plus another $16 million from tide-related coastal flooding (Maryland Emergency Management and Civil Defense Agency, written commun., 1986).

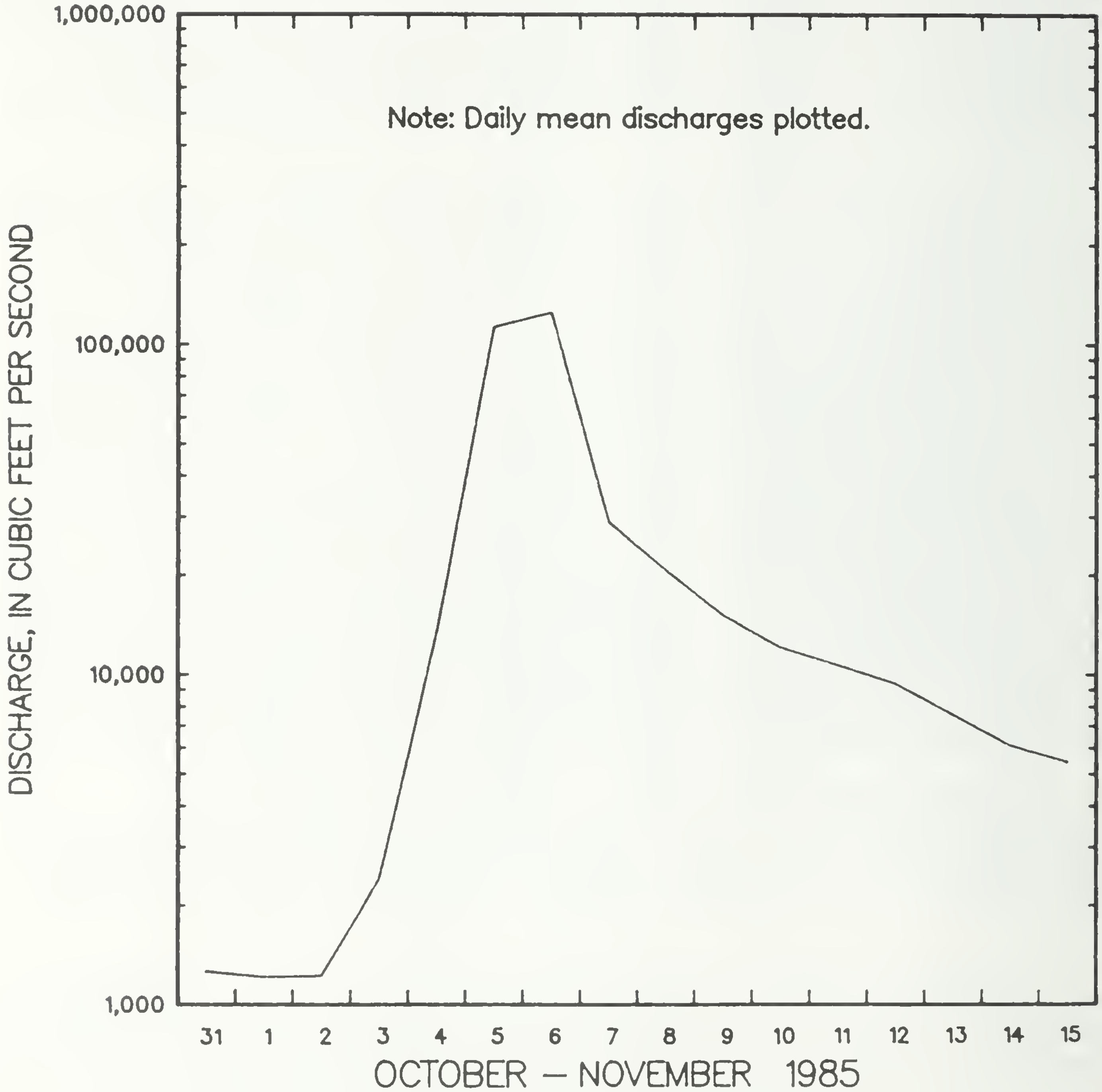



Figure 32.-- Discharge at gaging station Potomac River at Paw Paw, W. Va. (Site No. 15), October 31 - November 15, 1985.

Table 15.--Daily mean discharge for flood of November 1985 at gaging station Potomac River at Paw Paw, W. Va. (Site No. 15)

[Equivalent gage heights not given; stage affected by backwater; ft = feet; $ft^3/s$ = cubic feet per second]

| Date | Mean discharge ($ft^3/s$) |
|---|---|
| October 31---------- | 1,260 |
| November 1---------- | 1,210 |
| 2---------- | 1,220 |
| 3---------- | 2,400 |
| 4---------- | 13,400 |
| November 5---------- | [a]113,000 |
| 6---------- | 125,000 |
| 7---------- | 28,900 |
| 8---------- | 20,700 |
| 9---------- | 15,100 |
| November 10--------- | 12,100 |
| 11--------- | 10,700 |
| 12--------- | 9,400 |
| 13--------- | 7,570 |
| 14--------- | 6,100 |
| November 15--------- | 5,440 |

[a] Peak discharge (instantaneous maximum) occurred November 5, 235,000 $ft^3/s$; gage height = 53.6 ft.

The towns of Hancock and Point of Rocks were partially inundated by the flooding along the Potomac River. Smaller communities along the North Branch in the headwaters, such as Gorman, experienced significant damage. A public school building in the town of Oldtown, near the confluence of the North and South branches, was severely damaged, with losses estimated at $1.5 million.

In the upper reaches of the North Branch Potomac River, two reservoirs effectively reduced the flooding and related damage downstream, particularly in the vicinity of Cumberland. Bloomington Lake on the main stem North Branch and Savage River Dam on Savage River functioned to prevent damage to Maryland and West Virginia estimated at $142 million (combined) by the U.S. Army Corps of Engineers (Federal Emergency Management Agency, 1985c).

## SUMMARY

Heavy rains over the period October 31-November 6, 1985 (related to Hurricane Juan), caused major flooding over a large region of West Virginia, Virginia, Pennsylvania, and Maryland. Totals in excess of 10 in. of rain were recorded over much of the region.

As a result, the greatest floods on record occurred at many locations in each of the following major river basins: Potomac, James, Roanoke, Monongahela, and Kanawha. A summary of flood-peak data from 190 sites, including previous maximums and recurrence intervals, is given in table 16. At 40 streamflow-gaging stations in the region, recorded peak discharges were more than 50 percent greater than the previous maximums. At 63 gaging stations, the peaks equaled or exceeded 100-year recurrence intervals.

Extremely damaging floods occurred along the Cheat and South Branch Potomac Rivers. Some towns, such as Albright and Parsons, W. Va., were practically destroyed. The cities of Roanoke and Lynchburg, Va., on the Roanoke and James Rivers, respectively, were also extremely hard hit; property damage in the Roanoke-Salem area alone was estimated at $440 million. Property damage over the four-State affected region was estimated at $1,400 million, excluding tide-related coastal damage. There were 62 fatalities caused by the flooding. Countless homes, bridges, and other facilities were destroyed or badly damaged.

The operation of flood-control projects in several river basins resulted in significant reductions in the damage that occurred. Reservoirs in the Potomac, James, Monongahela, and Kanawha River basins functioned to attenuate the downstream flood peaks materially. Damage was reported to have been reduced by $135 million in West Virginia alone.

Regardless of how thorough a documentation is made of a disaster such as this flood, the impact cannot be adequately described in terms of deaths, monetary cost, and inconvenience. It needs also to be described in terms of the incredible power of nature and in terms of human endurance and damaged lives. To address these issues adequately is beyond the scope of this report. Nonetheless, there remains a valid need to document this flood disaster for posterity in hopes that the information will be used somehow to lessen the destruction more significantly the next time the forces of nature coalesce with such energy.

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## GLOSSARY

**Acre-foot** (acre-ft). The volume of water required to cover 1 acre to a depth of 1 foot. It equals 43,560 $ft^3$ (cubic feet), 325,851 gal (gallons), or 1,233 $m^3$ (cubic meters).

**Contents**. The volume of water in a reservoir or lake. Content is computed on the basis of a level pool or reservoir backwater profile and does not include bank storage.

**Convection cloud**. A cloud which owes its vertical development, and possibly its origin, to convection.

**Cubic feet per second** ($ft^3/s$). A rate of discharge. One cubic foot per second is equal to the discharge of a stream of rectangular cross section 1 foot wide and 1 foot deep, flowing at an average velocity of 1 ft/s (foot per second). It equals 28.32 L/s (liters per second) or 0.02832 $m^3/s$ (cubic meters per second).

**Cubic feet per second per square mile** [$(ft^3/s)/mi^2$]. The average number of cubic feet per second flowing from each square mile of area drained by a stream, assuming that the runoff is distributed uniformly in time and area. One $(ft^3/s)/mi^2$ is equivalent to 0.0733 $(m^3/s)/km^2$ (cubic meters per second per square kilometer).

**Drainage area of a stream at a specific location**. The area, measured in a horizontal plane, bounded by topographic divides. Drainage area is given in square miles ($mi^2$). One square mile is equivalent to 2.590 $km^2$ (square kilometers).

**Equivalent gage height.** The water-surface elevation corresponding to a discharge given as a mean (as in daily mean discharge). Equivalent gage height is given in feet (ft), see gage height.

**Flood**. Any high streamflow that overtops natural or artificial banks of a stream and overflows onto land not usually underwater, or ponding caused by precipitation at or near the point where it fell.

**Flood peak**. The highest value of the stage or discharge attained by a flood.

**Flood profile**. A graph of the elevation of water surface of a river in a flood--plotted as ordinate, against distance--plotted as abscissa.

**Flood stage**. The approximate elevation of the stream when overbank-flooding begins.

**Front**. The interface or transition zone between two airmasses of different density.

**Gage height**. The water-surface elevation referred to some arbitrary gage datum. Gage height commonly is used interchangeably with the more general term "stage." Gage height is given in feet (ft).

**Gaging station**. A particular site on a stream, canal, lake, or reservoir where systematic observations of gage height or discharge are made.

**Isohyet**. A line drawn on a map connecting points receiving equal rainfall.

**Jet stream**. High-velocity strong winds concentrated within a narrow stream high in the atmosphere.

**Miscellaneous site**. A site where data pertaining only to a specific hydrologic event are obtained.

**National Geodetic Vertical Datum of 1929** (NGVD of 1929). A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Sea Level Datum of 1929."

**Recurrence interval**. As applied to flood events, recurrence interval is the average number of years within which a given flood peak will be exceeded once.

**Runoff**. That part of the precipitation that appears in surface streams.

**Stage**. Water-surface elevation referred to some arbitrary datum, see gage height.

**Time of day is expressed in 24-hour time**. For example, 12:30 a.m. is 0030 hours; 1:00 p.m. is 1300 hours.

**Water year**. The period beginning October 1 and ending September 30 of the following calendar year, designated by the calendar year in which it ends. For example, the water year 1986 begins October 1, 1985, and ends September 30, 1986.

Table 16.--Summary of flood stages and discharges

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second;
- = information was not determined; footnotes found at end of table]

| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known | | | Maximum during flood November 1985 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Date | Gage height (ft) | Discharge ($ft^3/s$) | Date | Gage height (ft) | Discharge ($ft^3/s$) | Recurrence interval (years) |
| | | | | | POTOMAC RIVER BASIN | | | | | | | |
| 1 | 01595000 | North Branch Potomac River at Steyer, Md. | 73.0 | 2,276.01 | 1956-86 | 10/15/54 | [a]13.0 | 11,300 | Nov. 5 | 13.14 | 11,500 | >100 |
| 2 | 01595200 | Stony River near Mt. Storm, W. Va. | 48.8 | 2,554.54 | 1961-86 | 5/31/85 | 11.85 | 7,300 | Nov. 5 | 16.41 | 14,000 | b |
| 3 | 01595500 | North Branch Potomac River at Kitzmiller, Md. | 225 | 1,572.26 | 1949-86 | 10/15/54 | 13.73 | 33,400 | Nov. 5 | 14.85 | 50,400 | >100 |
| 4 | 01596500 | Savage River near Barton, Md. | 49.1 | 1,603.88 | 1948-86 | 10/15/54 | 8.45 | 7,510 | Nov. 5 | 6.57 | 4,320 | 25 |
| 5 | 01599000 | Georges Creek at Franklin, Md. | 72.4 | 958.96 | 1905-06, 1929-86 | 3/17/36 | [c]9.60 | 8,500 | Nov. 4 | 10.78 | 4,300 | 15 |
| 6 | 01601500 | Wills Creek near Cumberland, Md. | 247 | 640.89 | 1905-06, 1929-86 | 3/17/36 | [a]20.2 | 38,100 | Nov. 5 | 9.10 | 8,970 | 5 |
| 7 | 01603000 | North Branch Potomac River near Cumberland, Md. | 875 | 585.22 | 1929-86 | 6/1/1889 | [a]29.2 | 89,000 | Nov. 5 | 18.85 | 25,500 | 5 |
| 8 | 01604500 | Patterson Creek near Headsville, W. Va. | 219 | 624.90 | 1938-86 | 8/18/55 | 12.20 | 16,000 | Nov. 5 | 11.17 | 8,220 | 5 |
| 9 | 01605500 | South Branch Potomac River at Franklin, W. Va. | 182 | 1,692.5 | 1940-69, 1976-86 | 6/17/49<br>3/36 | 11.40<br>13 | 15,000<br>- | Nov. 4 | [a]22.58 | 44,000 | >100 |
| 10 | 01606000 | North Fork South Branch Potomac River at Cabins, W. Va. | 314 | 1,051.13 | 1940-61 | 6/17/49 | 18.0 | 50,000 | Nov. 5 | Unknown | 90,000 | >100 |

Table 16.--Summary of flood stages and discharges--Continued

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second; - = information was not determined; footnotes found at end of table]

| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known: Date | Maximum previously known: Gage height (ft) | Maximum previously known: Discharge ($ft^3/s$) | Maximum during flood November 1985: Date | Maximum during flood November 1985: Gage height (ft) | Maximum during flood November 1985: Discharge ($ft^3/s$) | Maximum during flood November 1985: Recurrence interval (years) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | POTOMAC RIVER BASIN--Continued | | | | | | | | | | |
| 11 | 01606500 | South Branch Potomac River near Petersburg, W. Va. | 642 | 962.00 | 1928-86 | 6/17/49<br>1877 | 22.83<br>[a]21.2 | 62,000<br>- | Nov. 5 | - | 130,000 | >100 |
| 12 | 01607500 | South Fork South Branch Potomac River at Brandywine, W. Va. | 102 | 1,558.35 | 1943-86 | 6/17/49 | [d]18 | 41,200 | Nov. 4 | [a]18.42 | 40,500 | b |
| 13 | 01608000 | South Fork South Branch Potomac River near Moorefield, W. Va. | 283 | 861.51 | 1928-35, 1938-86 | 6/18/49 | 16.1 | 39,000 | Nov. 5 | 19.99 | 110,000 | >100 |
| 14 | 01608500 | South Branch Potomac River near Springfield, W. Va. | 1,471 | 562.02 | 1894-96, 1899-06, 1928-86 | 3/18/36<br>1877 | 34.2<br>34 | 143,000<br>140,000 | Nov. 5 | [a]44.22 | 240,000 | >100 |
| 15 | 01610000 | Potomac River at Paw Paw, W. Va. | 3,109 | 487.88 | 1938-86 | 3/18/36 | 54.0 | 240,000 | Nov. 5 | 53.58 | 235,000 | >100 |
| 16 | 01611500 | Cacapon River near Great Cacapon, W. Va. | 677 | 456.78 | 1922-86 | 3/18/36<br>1889 | 30.1<br>24.7 | 87,600<br>57,500 | Nov. 5 | 21.95 | 44,500 | 20 |
| 17 | 01613000 | Potomac River at Hancock, Md. | 4,073 | 383.68 | 1932-86 | 3/18/36 | 47.6 | 340,000 | Nov. 6 | 41.20 | 207,000 | 50 |
| 18 | 01613900 | Hogue Creek near Hayfield, Va. | 15.0 | 668.60 | 1960-86 | 6/22/72 | 8.85 | 2,760 | Nov. 4 | 4.88 | 709 | <2 |
| 19 | 01614500 | Conococheague Creek at Fairview, Md. | 494 | 391.85 | 1928-86 | 6/23/72 | [a]24.5 | 32,400 | Nov. 5 | 7.92 | 4,760 | <2 |
| 20 | 01615000 | Opequon Creek near Berryville, Va. | 57.4 | 503.24 | 1943-86 | 10/42<br>11/13/70 | 18.4<br>12.82 | -<br>10,600 | Nov. 4 | 6.46 | 1,420 | <2 |

Table 16.--Summary of flood stages and discharges--Continued

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second; - = information was not determined; footnotes found at end of table]

| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known | | | Maximum during flood November 1985 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Date | Gage height (ft) | Discharge ($ft^3/s$) | Date | Gage height (ft) | Discharge ($ft^3/s$) | Recurrence interval (years) |
| | | POTOMAC RIVER BASIN--Continued | | | | | | | | | | |
| 21 | 01616000 | Abrams Creek near Winchester, Va. | 16.5 | 526.46 | 1949-60, 1977-86 | 12/14/50<br>2/14/84 | 6.16<br>5.34 | 962<br>982 | Nov. 4 | 3.73 | 520 | 5 |
| 22 | 01616500 | Opequon Creek near Martinsburg, W. Va. | 272 | 354.89 | 1905-06, 1947-86 | 6/22/72<br>1936 | 17.45<br>17.5 | 19,000<br>- | Nov. 4 | 9.82 | 2,570 | - |
| 23 | 01618000 | Potomac River at Shepherdstown, W. Va. | 5,936 | 281.00 | 1928-86 | 3/19/36 | [a]42.1 | 335,000 | Nov. 7 | 31.44 | 187,000 | 25 |
| 24 | 01620500 | North River near Stokesville, Va. | 17.2 | 2,054.57 | 1946-86 | 10/42<br>6/17/49 | [e]8.4<br>[e]10.9 | -<br>9,530 | Nov. 5 | [f]19.8 | 7,600 | >100 |
| 25 | 01621000 | Dry River at Rawley Springs, Va. | 72.6 | 1,606.42 | 1947-76 | 10/42 | 10.5 | 13,000 | Nov. 4 | 12.3 | 20,000 | >100 |
| 26 | 01622000 | North River near Burketown, Va. | 379 | 1,103.49 | 1925-72, 1979-86 | 6/18/49 | 36.3 | 62,600 | Nov. 5 | 35.85 | 65,000 | >100 |
| 27 | 01622400 | Buffalo Branch tributary near Christian, Va. | 0.49 | 1,622.53 | 1967-86 | 3/19/75 | 5.18 | 122 | Nov. 4 | 6.96 | 240 | >100 |
| 28 | 01624300 | Middle River near Verona, Va. | 178 | 1,260.78 | 1968-86 | 9/06/79 | 14.17 | 8,650 | Nov. 5 | 24.29 | 45,000 | >100 |
| 29 | 01624800 | Christians Creek near Fishersville, Va. | 70.1 | [g]1,230 | 1968-86 | 10/05/72 | 12.91 | 3,850 | Nov. 4 | 13.58 | 4,520 | >100 |
| 30 | 01625000 | Middle River near Grottoes, Va. | 375 | 1,061.51 | 1927-86 | 3/18/36 | 28.57 | 24,500 | Nov. 5 | 33.09 | 38,500 | >100 |
| 31 | 01626000 | South River near Waynesboro, Va. | 127 | 1,296.20 | 1952-86 | 10/42<br>8/20/69 | 14.3<br>15.27 | 14,500<br>17,400 | Nov. 4 | 15.30 | 17,500 | 30 |
| 32 | 01626850 | South River near Dooms, Va. | 149 | 1,247.04 | 1974-86 | 3/19/75 | 12.02 | 8,000 | Nov. 4 | 14.03 | 19,100 | 25 |

Table 16.--Summary of flood stages and discharges--Continued

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second;
- = information was not determined; footnotes found at end of table]

| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known | | | Maximum during flood November 1985 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Date | Gage height (ft) | Discharge ($ft^3/s$) | Date | Gage height (ft) | Discharge ($ft^3/s$) | Recurrence interval (years) |
| | | | | | | POTOMAC RIVER BASIN--Continued | | | | | | |
| 33 | 01627500 | South River at Harriston, Va. | 212 | 1,129.87 | 1925-51,<br>1960-86 | 1870<br>1877<br>10/15/42 | 18.8<br>18.8<br>17.2 | -<br>-<br>23,100 | Nov. 4 | 15.47 | 28,100 | 40 |
| 34 | 01628060 | White Oak Run near Grottoes, Va. | 1.94 | [g]1,480 | 1979-86 | 6/13/82<br>3/18/83 | -<br>3.90 | 255<br>200 | Nov. 4 | 6.17 | 515 | - |
| 35 | 01628500 | South Fork Shenandoah River near Lynnwood, Va. | 1,084 | 1,013.17 | 1930-86 | 10/15/42 | 27.2 | 80,000 | Nov. 5 | 29.46 | 95,100 | >100 |
| 36 | 01629500 | South Fork Shenandoah River near Luray, Va. | 1,377 | 721.76 | 1925-30,<br>1938-51,<br>1979-86 | 3/18/36<br>10/16/42 | 23.6<br>25.7 | 81,600<br>100,000 | Nov. 5 | 26.72 | 110,000 | 60 |
| 37 | 01629945 | Chub Run near Stanley, Va. | 3.16 | 1,023.05 | 1959-86 | 11/07/77 | 6.26 | 752 | Nov. 4 | 9.66 | 1,260 | 35 |
| 38 | 01631000 | South Fork Shenandoah River at Front Royal, Va. | 1,642 | 469.38 | 1899-06,<br>1930-86 | 10/16/42 | 34.8 | 130,000 | Nov. 6 | 32.43 | 120,000 | 60 |
| 39 | 01632000 | North Fork Shenandoah River at Cootes Store, Va. | 210 | 1,051.8 | 1925-86 | 10/15/42 | 25.3 | 50,000 | Nov. 4 | 25.13 | 49,200 | >100 |
| 40 | 01632900 | Smith Creek near New Market, Va. | 93.2 | 881.50 | 1960-86 | 10/06/72 | 16.38 | 10,600 | Nov. 5 | 13.01 | 6,050 | 10 |
| 41 | 01632970 | Crooked Run near Mt. Jackson, Va. | 6.49 | 962.84 | 1972-86 | 8/07/78 | 8.90 | 2,600 | Nov. 4 | 7.24 | 1,630 | 5 |
| 42 | 01633000 | North Fork Shenandoah River at Mt. Jackson, Va. | 506 | 838.55 | 1943-86 | 10/42<br>10/06/72 | 20.2<br>18.10 | 80,000<br>40,000 | Nov. 5 | 17.79 | 50,800 | 70 |
| 43 | 01633650 | Pughs Run near Woodstock, Va. | 3.66 | 1,027.27 | 1972-86 | 6/22/72 | 9.30 | 543 | Nov. 4 | 5.08 | 133 | 2 |

Table 16.--Summary of flood stages and discharges--Continued

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second; - = information was not determined; footnotes found at end of table]

| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known: Date | Maximum previously known: Gage height (ft) | Maximum previously known: Discharge ($ft^3/s$) | Maximum during flood November 1985: Date | Maximum during flood November 1985: Gage height (ft) | Maximum during flood November 1985: Discharge ($ft^3/s$) | Maximum during flood November 1985: Recurrence interval (years) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | POTOMAC RIVER BASIN--Continued | | | | | | | |
| 44 | 01634000 | North Fork Shenandoah River near Strasburg, Va. | 768 | 494.03 | 1925-86 | 10/16/42 | 31.2 | 100,000 | Nov. 5 | 27.37 | 62,600 | 70 |
| 45 | 01634500 | Cedar Creek near Winchester, Va. | 103 | 647.09 | 1937-86 | 10/15/42<br>3/17/36 | 27.0<br>25.0 | 22,000<br>18,000 | Nov. 5 | 16.05 | 8,980 | 15 |
| 46 | 01635500 | Passage Creek near Buckton, Va. | 87.8 | 525.14 | 1905-06,<br>1932-86 | 10/15/42 | 15.5 | 21,000 | Nov. 5 | 10.45 | 4,640 | 5 |
| 47 | 01636500 | Shenandoah River at Millville, W. Va. | 3,040 | 293.00 | 1895-09,<br>1928-86 | 10/16/42<br>3/18/36<br>1870 | 32.4<br>26.36<br>26.36 | 230,000<br>151,000<br>151,000 | Nov. 6 | 25.60 | 142,000 | 40 |
| 48 | 01638500 | Potomac River at Point of Rocks, Md. | 9,651 | 200.63 | 1895-86 | 3/19/36 | 41.03 | 480,000 | Nov. 7 | 36.28 | 309,000 | 25 |
| 49 | 01646500 | Potomac River near Washington, D.C. | 11,560 | 37.95 | 1930-86 | 3/19/36 | [h]28.1 | 484,000 | Nov. 7 | 17.99 | 317,000 | 25 |
| | | | | | RAPPAHANNOCK RIVER BASIN | | | | | | | |
| 50 | 01662000 | Rappahannock River near Warrenton, Va. | 195 | 312.57 | 1942-86 | 10/15/42 | 23.5 | 32,000 | Nov. 4 | 14.47 | 5,600 | 5 |
| 51 | 01662800 | Battle Run near Laurel Mills, Va. | 27.6 | 374.62 | 1958-86 | 10/09/76 | 13.90 | 9,120 | Nov. 4 | 12.46 | 5,060 | 20 |
| 52 | 01663500 | Hazel River at Rixeyville, Va. | 287 | 288.30 | 1942-86 | 4/26/37<br>10/15/42 | 28.4<br>31.8 | 43,500<br>60,000 | Nov. 4 | 24.79 | 29,500 | 20 |
| 53 | 01664000 | Rappahannock River at Remington, Va. | 620 | 252.53 | 1942-86 | 10/16/42 | 30.0 | 90,000 | Nov. 4 | 19.73 | 26,400 | 15 |
| 54 | 01665000 | Mountain Run near Culpeper, Va. | 15.9 | 389.46 | 1949-86 | 8/18/55<br>12/04/50 | 11.00<br>11.20 | 5,440<br>5,940 | Nov. 3 | 6.04 | 548 | <2 |

Table 16.--Summary of flood stages and discharges--Continued

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second; - = information was not determined; footnotes found at end of table]

| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known: Date | Maximum previously known: Gage height (ft) | Maximum previously known: Discharge ($ft^3/s$) | Maximum during flood November 1985: Date | Maximum during flood November 1985: Gage height (ft) | Maximum during flood November 1985: Discharge ($ft^3/s$) | Maximum during flood November 1985: Recurrence interval (years) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RAPPAHANNACK RIVER BASIN--Continued | | | | | | | | | | |
| 55 | 01665500 | Rapidan River near Ruckersville, Va. | 114 | 439.44 | 1942-86 | 10/15/42 | 20.8 | 30,700 | Nov. 5 | 14.72 | 12,600 | 10 |
| 56 | 01666500 | Robinson River near Locust Dale, Va. | 179 | 283.70 | 1943-86 | 10/15/42<br>6/22/72 | 23.9<br>20.92 | 44,000<br>24,500 | Nov. 5 | 20.17 | 17,200 | 15 |
| 57 | 01667500 | Rapidan River near Culpeper, Va. | 472 | 241.36 | 1930-86 | 10/16/42 | 30.3 | 58,100 | Nov. 5 | 22.52 | 28,500 | 10 |
| 58 | 01668000 | Rappahannock River near Fredericksburg, Va. | 1,596 | 55.18 | 1907-86 | 10/16/42 | 26.9 | 140,000 | Nov. 6 | 14.33 | 50,200 | 10 |
| | | JAMES RIVER BASIN | | | | | | | | | | |
| 59 | 02011400 | Jackson River near Bacova, Va. | 158 | 1,639.20 | 1974-86 | 12/26/73 | 13.88 | 7,560 | Nov. 4 | 22.25 | 30,000 | >100 |
| 60 | 02011460 | Back Creek near Sunrise, Va. | 60.1 | 2,200.02 | 1974-86 | 1/26/78 | 6.80 | 5,400 | Nov. 4 | 10.01 | 17,500 | >100 |
| 61 | 02011500 | Back Creek near Mountain Grove, Va. | 134 | 1,701.45 | 1951-86 | 3/07/67 | 10.77 | 12,700 | Nov. 4 | 11.24 | 14,200 | b |
| 62 | 02011800 | Jackson River below Gathright Dam near Hot Springs, Va. | 345 | 1,400.00 | 1973-86 | 12/26/73 | 18.77 | 29,000 | Nov. 6<br>Nov. 7 | 14.78<br>15.29 | 8,750<br>10,400 | b<br>b |
| 63 | 02012500 | Jackson River at Falling Spring, Va. | 411 | 1,333.49 | 1925-86 | 3/13<br>3/17/36 | 20<br>14.74 | 50,000<br>24,700 | Nov. 7 | 12.62 | 15,600 | b |
| 64 | 02012950 | Sweet Springs Creek tributary near Sweet Chalybeate, Va. | 0.66 | 1,926.94 | 1966-86 | 7/05/74 | 10.50 | 375 | Nov. 4 | 8.24 | 267 | 10 |

Table 16.--Summary of flood stages and discharges--Continued

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| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known: Date | Maximum previously known: Gage height (ft) | Maximum previously known: Discharge ($ft^3/s$) | Maximum during flood November 1985: Date | Maximum during flood November 1985: Gage height (ft) | Maximum during flood November 1985: Discharge ($ft^3/s$) | Maximum during flood November 1985: Recurrence interval (years) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | JAMES RIVER BASIN--Continued | | | | | | | | | | |
| 65 | 02013000 | Dunlap Creek near Covington, Va. | 164 | 1,294.70 | 1928-86 | 3/13<br>6/21/72 | 18.0<br>15.65 | -<br>27,400 | Nov. 4 | 13.42 | 17,400 | >100 |
| 66 | 02013100 | Jackson River below Dunlap Creek at Covington, Va. | 614 | 1,206.53 | 1974-86 | 6/21/72<br>4/05/77 | 24.36<br>19.85 | 34,000<br>23,200 | Nov. 4 | 23.31 | 31,300 | b |
| 67 | 02014000 | Potts Creek near Covington, Va. | 153 | 1,273.93 | 1928-56,<br>1965-86 | 11/1877<br>3/13<br>6/21/72 | 12.0<br>12.50<br>12.33 | -<br>-<br>12,400 | Nov. 4 | 13.46 | 15,400 | >100 |
| 68 | 02015600 | Cowpasture River near Head Waters, Va. | 11.3 | 1,985.65 | 1949-86 | 6/17/49 | 6.50 | 5,650 | Nov. 4 | 6.45 | 5,380 | >100 |
| 69 | 02015700 | Bullpasture River at Williamsville, Va. | 110 | 1,610.14 | 1960-86 | 4/05/77 | 9.25 | 9,430 | Nov. 4 | 14.39 | 22,900 | >100 |
| 70 | 02016000 | Cowpasture River near Clifton Forge, Va. | 461 | 1,006.93 | 1925-86 | 3/13<br>3/18/36 | 20.8<br>18.62 | 45,000<br>34,200 | Nov. 5 | 19.15 | 40,900 | >100 |
| 71 | 02016500 | James River at Lick Run, Va. | 1,373 | 978.30 | 1925-86 | 11/1877<br>3/13<br>3/18/36 | 33.0<br>30.4<br>27.01 | 120,000<br>98,000<br>66,600 | Nov. 5 | 30.22 | 87,500 | b |
| 72 | 02017300 | Craig Creek at New Castle, Va. | 112 | 1,245.69 | 1967-86 | 6/21/72 | 17.09 | 16,500 | Nov. 4 | 19.55 | 24,400 | >100 |
| 73 | 02017500 | Johns Creek at New Castle, Va. | 104 | 1,254.30 | 1926-86 | 1/23/35<br>6/21/72 | 10.80<br>12.48 | 8,000<br>7,960 | Nov. 4 | 11.96 | 7,010 | 25 |
| 74 | 02017700 | Craig Creek tributary near New Castle, Va. | 2.05 | - | 1968-86 | 9/21/79 | 9.99 | 579 | Nov. 4 | 13.45 | 1,100 | 70 |
| 75 | 02018000 | Craig Creek at Parr, Va. | 329 | 992.50 | 1925-86 | 6/21/72 | 19.29 | 20,200 | Nov. 4 | 24.76 | 58,500 | >100 |

Table 16.--Summary of flood stages and discharges--Continued

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second; - = information was not determined; footnotes found at end of table]

| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known | | | Maximum during flood November 1985 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Date | Gage height (ft) | Discharge ($ft^3/s$) | Date | Gage height (ft) | Discharge ($ft^3/s$) | Recurrence interval (years) |
| | | JAMES RIVER BASIN--Continued | | | | | | | | | | |
| 76 | 02018500 | Catawba Creek near Catawba, Va. | 34.3 | 1,299.96 | 1943-86 | 8/40<br>6/21/72 | 13.26<br>10.35 | -<br>7,740 | Nov. 4 | 19.19 | 21,200 | >100 |
| 77 | 02018800 | North Fork near Fincastle, Va. | 4.17 | 1,248.65 | 1968-86 | 9/21/79 | 9.88 | 1,230 | Nov. 4 | 10.39 | 3,470 | >100 |
| 78 | 02019500 | James River at Buchanan, Va. | 2,075 | 802.90 | 1898-86 | 11/1877<br>3/27/13 | 34.9<br>31 | 142,000<br>115,000 | Nov. 5 | 38.84 | 179,000 | >100 |
| 79 | 02020100 | Renick Run near Buchanan, Va. | 2.06 | 1,261.85 | 1967-86 | 8/20/69 | 9.90 | 1,210 | Nov. 4 | 5.88 | 472 | 4 |
| 80 | 02020500 | Calfpasture River above Mill Creek at Goshen, Va. | 144 | 1,384.84 | 1938-86 | 10/06/72 | 12.78 | 20,900 | Nov. 4 | 20.23 | 56,300 | >100 |
| 81 | 02021500 | Maury River at Rockbridge Baths, Va. | 329 | 1,100.33 | 1928-86 | 3/17/36 | 13.07 | 33,000 | Nov. 5 | 19.19 | 87,700 | >100 |
| 82 | 02021700 | Cedar Grove Branch near Rockbridge Baths, Va. | 12.3 | 1,041.22 | 1967-86 | 8/20/69 | 31.20 | 7,300 | Nov. 4 | 10.87 | 830 | 2 |
| 83 | 02022500 | Kerrs Creek near Lexington, Va. | 35.0 | 980.32 | 1926-86 | 9/10/50 | 13.8 | 23,000 | Nov. 4 | 11.37 | 9,450 | 20 |
| 84 | 02023300 | South River near Steeles Tavern, Va. | 15.7 | [9]1,600 | 1936-86 | 8/20/69 | 8.70 | 4,700 | Nov. 4 | 6.53 | 2,680 | 20 |
| 85 | 02024000 | Maury River near Buena Vista, Va. | 646 | 846.58 | 1938-86 | 3/18/36<br>8/20/69 | 22<br>31.23 | -<br>105,000 | Nov. 5 | 26.30 | 72,100 | >100 |
| 86 | 02025500 | James River at Holcombs Rock, Va. | 3,259 | 548.53 | 1900-15,<br>1926-86 | 3/28/13<br>8/20/69 | 31.3<br>35.50 | 118,000<br>150,000 | Nov. 5 | 42.15 | 207,000 | >100 |

Table 16.--Summary of flood stages and discharges--Continued

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second; - = information was not determined; footnotes found at end of table]

| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known | | | Maximum during flood November 1985 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Date | Gage height (ft) | Discharge ($ft^3/s$) | Date | Gage height (ft) | Discharge ($ft^3/s$) | Recurrence interval (years) |
| | | JAMES RIVER BASIN--Continued | | | | | | | | | | |
| 87 | 02026000 | James River at Bent Creek, Va. | 3,683 | 381.39 | 1924-86 | 9/30/1870<br>8/20/69<br>6/21/72 | 27.0<br>24.77<br>27.13 | 150,000<br>144,000<br>176,000 | Nov. 5 | 30.76 | 226,000 | >100 |
| 88 | 02027000 | Tye River near Lovingston, Va. | 92.8 | 578.39 | 1938-86 | 8/20/69 | 29.0 | 80,000 | Nov. 4 | 14.46 | 12,700 | 10 |
| 89 | 02027500 | Piney River at Piney River, Va. | 47.6 | 633.58 | 1949-86 | 6/49<br>8/20/69 | 9.9<br>13.8 | -<br>38,000 | Nov. 4 | 12.63 | 25,200 | 90 |
| 90 | 02027800 | Buffalo River near Tye River, Va. | 147 | 444.39 | 1960-86 | 8/20/69 | 27.95 | 45,000 | Nov. 5 | 15.26 | 13,500 | 10 |
| 91 | 02028500 | Rockfish River near Greenfield, Va. | 94.6 | 530.29 | 1943-86 | 10/15/42<br>8/20/69 | 23.4<br>31.2 | 30,000<br>70,000 | Nov. 4 | 13.24 | 9,970 | 5 |
| 92 | 02029000 | James River at Scottsville, Va. | 4,584 | 253.18 | 1924-86 | 10/1870<br>8/20/69<br>6/22/72 | 30.7<br>30.00<br>34.02 | 215,000<br>188,000<br>301,000 | Nov. 6 | 31.77 | 243,000 | >100 |
| 93 | 02030500 | Slate River near Arvonia, Va. | 226 | 238.78 | 1926-86 | 6/22/72 | 25.10 | 42,200 | Nov. 5 | 14.10 | 6,930 | 5 |
| 94 | 02030800 | Stockton Creek near Afton, Va. | 2.80 | 835.27 | 1967-86 | 6/21/72 | 9.68 | 678 | Nov. 4 | 8.18 | 520 | 20 |
| 95 | 02031000 | Mechums River near White Hall, Va. | 95.4 | 429.75 | 1942-51,<br>1979-86 | 10/15/42<br>9/06/79 | 30.3<br>24.5 | 20,000<br>13,500 | Nov. 5 | 21.11 | 9,960 | 7 |
| 96 | 02032200 | Doyles River near White Hall, Va. | 6.70 | 928.08 | 1967-86 | 9/22/79 | 13.73 | - | Nov. 4 | 13.06 | 1,780 | - |
| 97 | 02032250 | Moormans River near Free Union, Va. | 74.6 | 403.11 | 1979-86 | 6/21/72<br>9/06/79 | 20.2<br>21.55 | 15,100<br>16,500 | Nov. 4 | 20.41 | 15,500 | - |
| 98 | 02032300 | Muddy Run near Stanardsville, Va. | 3.36 | 756.79 | 1967-86 | 5/13/78<br>8/28/79 | 8.33<br>8.33 | 5,650<br>5,650 | Nov. 4 | 7.22 | 3,190 | 5 |

Table 16.--Summary of flood stages and discharges--Continued

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second; - = information was not determined; footnotes found at end of table]

| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known | | | Maximum during flood November 1985 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Date | Gage height (ft) | Discharge ($ft^3/s$) | Date | Gage height (ft) | Discharge ($ft^3/s$) | Recurrence interval (years) |
| | | JAMES RIVER BASIN--Continued | | | | | | | | | | |
| 99 | 02032515 | South Fork Rivanna River near Charlottesville, Va. | 260 | [9]330 | 1979-86 | 9/06/79 | 23.50 | 15,200 | Nov. 5 | 22.70 | 14,300 | - |
| 100 | 02032540 | Haneytown Creek near Stanardsville, Va. | 4.45 | 616.34 | 1967-86 | 3/19/75 | 13.85 | 1,220 | Nov. 4 | 13.34 | 854 | 5 |
| 101 | 02032550 | Lynch River at Nortonsville, Va. | 13.6 | 591.70 | 1967-86 | 6/21/72<br>10/05/72 | 16.50<br>16.46 | 18,000<br>18,000 | Nov. 4 | 15.60 | 13,000 | 5 |
| 102 | 02032680 | North Fork Rivanna River near Proffit, Va. | 176 | 323.43 | 1970-86 | 6/21/72 | 30.4 | 31,800 | Nov. 5 | 18.64 | 10,900 | 2 |
| 103 | 02034000 | Rivanna River at Palmyra, Va. | 664 | 210.39 | 1933-86 | 8/20/69<br>6/22/72 | 39.85<br>37.34 | 86,000<br>73,400 | Nov. 5 | 26.53 | 31,800 | 5 |
| 104 | 02034500 | Willis River at Lakeside Village, Va. | 262 | 178.98 | 1926-86 | 6/22/72 | 29.8 | 24,000 | Nov. 6 | 22.97 | 9,470 | 15 |
| 105 | 02035000 | James River at Cartersville, Va. | 6,257 | 163.90 | 1898-86 | 11/1877<br>3/19/36<br>10/16/42<br>8/21/69<br>6/22/72 | 30.4<br>28.77<br>27.14<br>33.75<br>37.87 | -<br>166,000<br>135,000<br>250,000<br>362,000 | Nov. 6 | 32.60 | 225,000 | 60 |
| 106 | 02037500 | James River near Richmond, Va. | 6,758 | 98.82 | 1934-86 | 3/19/36<br>8/21/69<br>6/23/72 | 23.42<br>24.95<br>28.62 | 175,000<br>222,000<br>313,000 | Nov. 7 | 24.77 | 218,000 | 30 |
| 107 | 02038000 | Falling Creek near Chesterfield, Va. | 32.8 | 126.39 | 1955-86 | 10/01/79 | 15.32 | 5,930 | Nov. 4 | 11.63 | 1,820 | 10 |
| 108 | 02038850 | Holiday Creek near Andersonville, Va. | 8.53 | 472.97 | 1966-86 | 6/21/72 | 14.64 | 9,640 | Nov. 4 | 6.80 | 1,220 | 5 |
| 109 | 02039500 | Appomattox River at Farmville, Va. | 303 | 281.93 | 1926-86 | 6/22/72 | 29.70 | 33,100 | Nov. 5 | 20.03 | 9,400 | 5 |

Table 16.--Summary of flood stages and discharges--Continued

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second; - = information was not determined; footnotes found at end of table]

| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known: Date | Maximum previously known: Gage height (ft) | Maximum previously known: Discharge ($ft^3/s$) | Maximum during flood November 1985: Date | Maximum during flood November 1985: Gage height (ft) | Maximum during flood November 1985: Discharge ($ft^3/s$) | Maximum during flood November 1985: Recurrence interval (years) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | CHOWAN RIVER BASIN | | | | | | | |
| 110 | 02044000 | Nottoway River near Burkeville, Va. | 38.7 | 354.58 | 1946-86 | 8/40<br>10/23/71 | 27.4<br>22.33 | -<br>13,400 | Nov. 4 | 13.62 | 1,620 | <2 |
| 111 | 02044500 | Nottoway River near Rawlings, Va. | 309 | 184.88 | 1950-86 | 8/40<br>10/06/72 | 20.8<br>23.25 | 19,000<br>29,900 | Nov. 4 | 16.43 | 12,200 | 10 |
| 112 | 02045500 | Nottoway River near Stony Creek, Va. | 579 | 58.42 | 1929-86 | 8/17/40 | 23.66 | 25,200 | Nov. 6 | 20.22 | 14,800 | 20 |
| 113 | 02051000 | North Meherrin River near Lunenburg, Va. | 55.6 | 333.7 | 1946-80,<br>1981-86 | 8/40<br>10/23/71 | 48<br>28.30 | -<br>14,400 | Nov. 4 | 15.42 | 2,690 | 2 |
| 114 | 02051500 | Meherrin River near Lawrenceville, Va. | 552 | 136.56 | 1928-86 | 8/17/40 | 42.0 | 38,000 | Nov. 5 | 28.98 | 15,000 | 15 |
| 115 | 02052000 | Meherrin River at Emporia, Va. | 747 | 67.17 | 1951-86 | 8/17/40<br>10/08/72 | 31.5<br>27.38 | 40,000<br>21,100 | Nov. 6 | 25.74 | 17,500 | 15 |
| | | | | | ROANOKE RIVER BASIN | | | | | | | |
| 116 | 02053800 | South Fork Roanoke River near Shawsville, Va. | 110 | 1,361.87 | 1960-86 | 6/21/72 | 11.12 | 14,200 | Nov. 4 | 8.81 | 7,070 | 20 |
| 117 | 02054500 | Roanoke River at Lafayette, Va. | 257 | 1,174.47 | 1943-86 | 8/40<br>6/21/72 | 12.2<br>15.60 | 19,000<br>24,500 | Nov. 4 | 13.34 | 17,100 | 40 |
| 118 | 02055000 | Roanoke River at Roanoke, Va. | 395 | 906.84 | 1899-86 | 8/14/40<br>6/21/72 | 18.25<br>19.61 | 22,800<br>25,300 | Nov. 4 | 23.35 | 32,300 | >100 |
| 119 | 02055100 | Tinker Creek near Daleville, Va. | 11.7 | 1,217.47 | 1956-86 | 8/40<br>6/21/72 | 9.0<br>9.82 | -<br>4,000 | Nov. 4 | 13.36 | 10,400 | >100 |
| 120 | 02056000 | Roanoke River at Niagara, Va. | 512 | 820.15 | 1926-86 | 8/14/40<br>6/21/72<br>4/27/78 | 17.50<br>18.90<br>19.12 | 24,400<br>28,800<br>29,300 | Nov. 4 | 25.30 | 52,300 | >100 |

Table 16.--Summary of flood stages and discharges--Continued

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second; - = information was not determined; footnotes found at end of table]

| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known | | | Maximum during flood November 1985 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Date | Gage height (ft) | Discharge ($ft^3/s$) | Date | Gage height (ft) | Discharge ($ft^3/s$) | Recurrence interval (years) |
| | | ROANOKE RIVER BASIN--Continued | | | | | | | | | | |
| 121 | 02056650 | Back Creek near Dundee, Va. | 56.8 | 822.67 | 1974-86 | 6/21/72<br>5/29/76 | 20.0<br>15.00 | -<br>7,500 | Nov. 4 | 25.1 | 20,000 | >100 |
| 122 | 02056900 | Blackwater River near Rocky Mount, Va. | 115 | 876.45 | 1976-86 | 9/22/79 | 16.38 | 8,130 | Nov. 5 | 21.92 | 20,800 | >100 |
| 123 | 02058400 | Pigg River near Sandy Level, Va. | 350 | 617.00 | 1963-86 | 4/27/78 | 25.56 | 25,400 | Nov. 4 | 19.50 | 13,800 | 5 |
| 124 | 02059500 | Goose Creek near Huddleston, Va. | 188 | 592.91 | 1925-28,<br>1930-86 | 10/19/37 | 25.75 | 20,300 | Nov. 4 | 22.05 | 14,600 | 10 |
| 125 | 02060500 | Roanoke River at Altavista, Va. | 1,789 | 503.10 | 1930-86 | 8/15/40 | 40.08 | 105,000 | Nov. 5 | 27.38 | 35,700 | b |
| 126 | 02061500 | Big Otter River near Evington, Va. | 320 | 544.02 | 1936-86 | 10/19/37 | 23.14 | 27,500 | Nov. 5 | 22.69 | 27,100 | 35 |
| 127 | 02065500 | Cub Creek at Phenix, Va. | 98.0 | 370.19 | 1946-86 | 6/22/72 | 20.37 | 7,380 | Nov. 4 | 12.74 | 4,240 | 25 |
| 128 | 02066000 | Roanoke River at Randolph, Va. | 2,977 | 307.59 | 1900-06,<br>1927-30,<br>1950-86 | 12/31/01<br>8/16/40 | -<br>41.6 | 97,000<br>150,000 | Nov. 6 | 29.58 | 51,200 | b |
| 129 | 02076200 | Bearskin Creek near Chatham, Va. | 4.06 | [g]630 | 1967-86 | 6/21/72 | 13.12 | 1,920 | Nov. 4 | 16.00 | 2,300 | 30 |
| 130 | 02076500 | Georges Creek near Gretna, Va. | 9.24 | 629.54 | 1949-86 | 9/22/79 | 8.50 | 1,480 | Nov. 4 | 7.33 | 1,160 | 10 |
| | | MONONGAHELA RIVER BASIN | | | | | | | | | | |
| 131 | 03050500 | Tygart Valley River near Elkins, W. Va. | 272 | [i]1,893.95 | 1944-86 | 12/31/69 | 15.65 | 13,100 | Nov. 5 | [a]22.81 | 23,500 | >100 |

Table 16.--Summary of flood stages and discharges--Continued

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second; - = information was not determined; footnotes found at end of table]

| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known: Date | Maximum previously known: Gage height (ft) | Maximum previously known: Discharge ($ft^3/s$) | Maximum during flood November 1985: Date | Maximum during flood November 1985: Gage height (ft) | Maximum during flood November 1985: Discharge ($ft^3/s$) | Maximum during flood November 1985: Recurrence interval (years) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MONONGAHELA RIVER BASIN--Continued | | | | | | | | | | |
| 132 | 03051000 | Tygart Valley River at Belington, W. Va. | 408 | [i]1,679.49 | 1907-86 | 7/25/12 | [j]20.3 | 18,400 | Nov. 5 | 23.65 | 29,500 | >100 |
| 133 | 03052500 | Sand Run near Buckhannon, W. Va. | 14.5 | [g]1,530 | 1946-86 | 6/25/50 | 6.29 | 2,000 | Nov. 4 | 8.34 | 3,200 | 50 |
| 134 | 03053500 | Buckhannon River at Hall, W. Va. | 277 | - | 1907-09, 1915-86 | 3/07/67 | 15.07 | 13,000 | Nov. 5 | 16.88 | 15,000 | >100 |
| 135 | 03054500 | Tygart Valley River at Philippi, W. Va. | 916 | 1,280.55 | 1940-86 | 3/07/67<br>7/25/12 | [d]25.93<br>26 | 43,000<br>37,000 | Nov. 5 | [a]31.83 | 61,000 | >100 |
| 136 | 03056250 | Three Forks Creek near Grafton, W. Va. | 97.4 | [g]1,000 | 1984-86 | - | - | - | Nov. 5 | 20.13 | 12,000 | [k]>100 |
| 137 | 03057000 | Tygart Valley River at Colfax, W. Va. | 1,366 | 856.27 | 1939-86 | 2/14/48<br>1888 | [m]16.86<br>39.6 | 22,500<br>- | Nov. 5 | [f]18.89 | - | b |
| 138 | 03057300 | West Fork River at Walkersville, W. Va. | 28.9 | 1,070.64 | 1984-86 | - | - | - | Nov. 4 | 17.87 | 3,390 | [k]25 |
| 139 | 03058500 | West Fork River at Butcherville, W. Va. | 181 | - | 1915-86 | 6/25/50<br>1888 | [n]16.81<br>17 | 18,000<br>- | Nov. 5 | 15.20 | 14,400 | b |
| 140 | 03061000 | West Fork River at Enterprise, W. Va. | 759 | [i]869.45 | 1907-18, 1932-86 | 3/07/67<br>1888 | 28.05<br>33 | 36,500<br>- | Nov. 5 | 30.37 | 41,100 | b |
| 141 | 03061500 | Buffalo Creek at Barrackville, W. Va. | 115 | 884.4 | 1907-08, 1915-24, 1932-86 | 1/22/17<br>7/12 | 16.2<br>18.0 | 9,490<br>- | Nov. 5 | 14.73 | 8,000 | 10 |
| 142 | 03062400 | Cobun Creek at Morgantown, W. Va. | 10.9 | [g]890 | 1965-86 | 8/18/80 | 19.94 | 3,100 | Nov. 5 | 7.76 | 684 | - |
| 143 | 03065000 | Dry Fork at Hendricks, W. Va. | 345 | [i]1,698.76 | 1940-86 | 10/15/54 | 15.23 | 47,000 | Nov. 5 | [a]20.74 | 100,000 | >100 |

Table 16.--Summary of flood stages and discharges--Continued

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second; - = information was not determined; footnotes found at end of table]

| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known | | | Maximum during flood November 1985 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Date | Gage height (ft) | Discharge ($ft^3/s$) | Date | Gage height (ft) | Discharge ($ft^3/s$) | Recurrence interval (years) |
| | | | | | | MONONGAHELA RIVER BASIN--Continued | | | | | | |
| 144 | 03066000 | Blackwater River at Davis, W. Va. | 86.2 | 3,058.87 | 1921-86 | 3/29/24 | 13.20 | 7,170 | Nov. 5 | 17.67 | 12,500 | >100 |
| 145 | 03069000 | Shavers Fork at Parsons, W. Va. | 214 | 1,634.87 | 1910-26, 1940-86 | 3/20/82<br>7/10/1888<br>7/17/07 | 12.02<br>[h]12.5<br>[h]12.5 | 16,800<br>25,000<br>25,000 | Nov. 5 | 19.86 | 43,000 | >100 |
| 146 | 03069500 | Cheat River near Parsons, W. Va. | 718 | [i]1,589.66 | 1913-86 | 10/15/54<br>7/10/1888 | 19.08<br>[q]20.5 | 82,000<br>- | Nov. 5 | 24.3 | [p]170,000 | >100 |
| 147 | 03070000 | Cheat River at Rowlesburg, W. Va. | 972 | 1,370.24 | 1912-86 | 10/16/54<br>7/06/1844<br>7/10/1888 | 15.67<br>[r]16.7<br>[r]16.2 | -<br>125,000<br>118,000 | Nov. 5 | - | [p]190,000 | >100 |
| 148 | 03070500 | Big Sandy Creek at Rockville, W. Va. | 200 | [g]1,310 | 1909-18, 1921-86 | 7/24/12<br>7/10/1888 | 18.0<br>20 | 21,300<br>30,000 | Nov. 5 | 11.76 | 7,140 | - |
| 149 | 03072000 | Dunkard Creek at Shannopin, Pa. | 229 | 806.25 | 1940-86 | 8/18/80 | 14.27 | 17,600 | Nov. 5 | 10.34 | 7,600 | 2 |
| 150 | 03072500 | Monongahela River at Greensboro, Pa. | 4,407 | 767.55 | 1938-86 | 3/07/67 | 29.61 | 134,000 | Nov. 5 | [a]39.39 | 220,000 | >100 |
| 151 | 03073000 | South Fork Tenmile Creek at Jefferson, Pa. | 180 | 852.54 | 1931-86 | 6/04/41 | 18.45 | 13,800 | Nov. 5 | 11.32 | 6,440 | 2 |
| 152 | 03074500 | Redstone Creek at Waltersburg, Pa. | 73.7 | 883.28 | 1942-86 | 6/23/72 | 14.83 | 8,660 | Nov. 5 | 5.50 | 1,760 | <2 |
| 153 | 03075070 | Monongahela River at Elizabeth, Pa. | 5,340 | 725.50<br>[s]735.33 | 1933-86 | 3/07/67 | [a,s]41.63 | [s]158,000 | Nov. 6 | 23.60 | 178,000 | [t]85 |
| 154 | 03075500 | Youghiogheny River near Oakland, Md. | 134 | 2,353.61 | 1941-86 | 10/16/54 | 12.16 | 11,800 | Nov. 5 | 12.07 | 11,700 | 50 |
| 155 | 03076500 | Youghiogheny River at Friendsville, Md. | 295 | 1,487.33 | 1898-1904, 1940-86 | 3/29/24 | [a]10.2 | 15,600 | Nov. 5 | 8.59 | 13,000 | 25 |

Table 16.--Summary of flood stages and discharges--Continued

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second; - = information was not determined; footnotes found at end of table]

| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known | | | Maximum during flood November 1985 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Date | Gage height (ft) | Discharge ($ft^3/s$) | Date | Gage height (ft) | Discharge ($ft^3/s$) | Recurrence interval (years) |
| | | MONONGAHELA RIVER BASIN--Continued | | | | | | | | | | |
| 156 | 03076600 | Bear Creek at Friendsville, Md. | 48.9 | 1,551.34 | 1964-86 | 9/14/71 | [a]9.6 | 4,650 | Nov. 5 | 5.43 | 1,910 | 10 |
| 157 | 03077500 | Youghiogheny River at Youghiogheny River Dam, Pa. | 436 | 1,310.17 | 1939-86 | 3/05/48 | 11.28 | 13,700 | Nov. 5 | [f]8.58 | - | - |
| 158 | 03078000 | Casselman River at Grantsville, Md. | 62.5 | 2,088.97 | 1947-86 | 10/15/54 | 10.70 | 8,400 | Nov. 5 | 7.04 | 4,030 | 10 |
| 159 | 03079000 | Casselman River at Markleton, Pa. | 382 | 1,655.29 | 1920-86 | 10/15/54 | 14.06 | 50,000 | Nov. 5 | 9.58 | 17,900 | 5 |
| 160 | 03080000 | Laurel Hill Creek at Ursina, Pa. | 121 | 1,335.26 | 1918-86 | 10/15/54 | 10.63 | 10,900 | Nov. 5 | 3.41 | 1,930 | <2 |
| 161 | 03081000 | Youghiogheny River below Confluence, Pa. | 1,029 | 1,302.77 | 1940-86 | 3/18/36 | [a]21.6 | 85,000 | Nov. 5 | 10.56 | 18,400 | 5 |
| 162 | 03082500 | Youghiogheny River at Connellsville, Pa. | 1,326 | 860.13 | 1908-86 | 10/16/54 | 21.96 | 103,000 | Nov. 5 | 10.74 | 22,000 | <2 |
| 163 | 03083500 | Youghiogheny River at Sutersville, Pa. | 1,715 | 733.36 | 1920-86 | 10/16/54 | [a]32.5 | 108,000 | Nov. 5 | 14.78 | 22,000 | <2 |
| 164 | 03085000 | Monongahela River at Braddock, Pa. | 7,337 | 707.16 | 1938-86 | 3/18/36 | [a]38.8 | 210,000 | Nov. 6 | 29.07 | 190,000 | 25 |
| | | WHEELING CREEK BASIN | | | | | | | | | | |
| 165 | 03112000 | Wheeling Creek at Elm Grove, W. Va. | 282 | 667.59 | 1940-86 | 12/30/42 | 13.67 | 22,100 | Nov. 5 | 6.56 | 6,840 | - |

Table 16.--Summary of flood stages and discharges--Continued

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second; - = information was not determined; footnotes found at end of table]

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MIDDLE ISLAND CREEK BASIN | | | | | | | | | | |
| 166 | 03114500 | Middle Island Creek at Little, W. Va. | 458 | [i]631.32 | 1915-22, 1928-86 | 6/26/50<br>1875 | 28.0<br>33.5 | 25,000<br>- | Nov. 5 | 25.12 | 24,200 | 50 |
| | | LITTLE KANAWHA RIVER BASIN | | | | | | | | | | |
| 167 | 03151400 | Little Kanawha River near Wildcat, W. Va. | 112 | 850.00 | 1973-86 | 1/26/78 | 12.62 | 7,090 | Nov. 5 | 14.81 | 10,500 | 50 |
| 168 | Miscel-laneous site | Oil Creek at Burnsville, W. Va. | 23.9 | - | - | - | - | - | Nov. 5 | - | 10,500 | [k] >100 |
| 169 | Miscel-laneous site | Sand Fork near Sand Fork, W. Va. | 34.4 | - | - | - | - | - | Nov. 5 | - | 9,000 | [k] >100 |
| 170 | 03152000 | Little Kanawha River at Glenville, W. Va. | 386 | 697.79 | 1915-22, 1928-86 | 3/07/67<br>11/16/26 | [f]34.50<br>33.6 | 21,500<br>- | Nov. 5 | [a]36.46 | 26,900 | b |
| 171 | 03153500 | Little Kanawha River at Grantsville, W. Va. | 913 | [i]652.83 | 1928-86 | 3/07/67 | 43.9 | 35,100 | Nov. 5 | 42.87 | 33,700 | b |
| 172 | 03154000 | West Fork Little Kanawha River at Rocksdale, W. Va. | 205 | [i]657.85 | 1928-31, 1937-86 | 4/16/39 | 30.3 | 20,200 | Nov. 5 | 22.03 | 7,420 | - |
| 173 | 03155000 | Little Kanawha River at Palestine, W. Va. | 1,515 | 585.51 | 1915-22, 1939-86 | 3/07/67<br>4/17/39 | 39.14<br>[u]32.25 | 50,700<br>53,000 | Nov. 6 | 34.43 | 39,800 | b |
| 174 | 03155500 | Hughes River at Cisco, W. Va. | 452 | [i]607.92 | 1915-22, 1928-31, 1938-86 | 6/26/50 | 32.69 | 31,700 | Nov. 5 | 30.87 | 24,800 | 20 |
| 175 | 03168000 | New River at Allisonia, Va. | 2,202 | 1,848.36 | 1929-86 | 8/14/40 | 23.42 | 185,000 | Nov. 5 | 7.82 | 32,100 | 2 |
| 176 | 03170000 | Little River at Graysonton, Va. | 300 | 1,816.04 | 1928-86 | 6/21/72 | 13.40 | 22,800 | Nov. 5 | 11.67 | 18,200 | 40 |

Table 16.--Summary of flood stages and discharges--Continued

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | KANAWHA RIVER BASIN | | | | | | | | | | |
| 177 | 03179000 | Bluestone River at Pipestem, W. Va. | 394 | 1,527.35 | 1950-86 | 4/05/77 | 15.82 | 19,300 | Nov. 5 | 6.80 | 1,940 | - |
| 178 | 03180500 | Greenbrier River at Durbin, W. Va. | 133 | 2,699.71 | 1943-86 | 3/07/67 | 9.15 | 12,200 | Nov. 4 | 15.82 | 37,100 | >100 |
| 179 | 03182000 | Knapp Creek at Marlinton, W. Va. | 108 | - | 1946-58, 1980 | 7/15/54<br>7/21/80 | 13.86<br>24.50 | 7,710 | Nov. 5 | - | 15,600 | >100 |
| 180 | 03182500 | Greenbrier River at Buckeye, W. Va. | 540 | 2,085.89 | 1929-86 | 2/05/32 | 17.5 | 41,500 | Nov. 5 | [a]23.2 | 82,000 | >100 |
| 181 | 03183500 | Greenbrier River at Alderson, W. Va. | 1,364 | 1,529.42 | 1895-86 | 3/14/18 | 22.0 | 77,500 | Nov. 5 | 23.95 | 90,600 | >100 |
| 182 | 03184000 | Greenbrier River at Hilldale, W. Va. | 1,619 | 1,388.66 | 1936-86 | 12/27/73<br>3/18/36 | 23.13<br>21.85 | 58,100<br>60,800 | Nov. 6 | [a]25.68 | [p]83,800 | >100 |
| 183 | 03184500 | New River at Hinton, W. Va. | 6,256 | 1,355.18 | 1936-86 | 8/15/40 | 18.97 | 246,000 | Nov. 6 | 9.91 | 78,200 | b |
| 184 | 03186500 | Williams River at Dyer, W. Va. | 128 | [i]2,193.46 | 1929-86 | 7/04/32 | 18.45 | 22,000 | Nov. 4 | 16.69 | 19,400 | 100 |
| 185 | 03187500 | Cranberry River near Richwood, W. Va. | 80.4 | [g]2,100 | 1944-51, 1954, 1964-82, 1984-86 | 7/19/54<br>8/31/84 | 12.22<br>11.0 | 18,000<br>9,900 | Nov. 4 | 11.41 | 10,500 | 100 |
| 186 | 03189100 | Gauley River near Craigsville, W. Va. | 529 | 1,870.00 | 1964-86 | 3/07/67 | 22.73 | 40,700 | Nov. 4 | 25.72 | 61,800 | 100 |
| 187 | 03190400 | Meadow River near Mt. Lookout, W. Va. | 365 | [g]1,200 | 1966-86 | 3/07/67 | 13.44 | 18,500 | Nov. 6 | 10.04 | 8,100 | - |
| 188 | 03194000 | Elk River at Webster Springs, W. Va. | 171 | [g]1,500 | 1908-16 | 1/29/11 | 11.00 | 17,300 | Nov. 4 | - | 27,000 | >100 |

Table 16.--Summary of flood stages and discharges--Continued

[$mi^2$ = square miles; ft = feet; $ft^3/s$ = cubic feet per second; - = information was not determined; footnotes found at end of table]

| Site No. | Permanent station No. | Stream and place of determination | Drainage area ($mi^2$) | Datum of gage above National Geodetic Vertical Datum of 1929 (ft) | Period of flood record | Maximum previously known | | | Maximum during flood November 1985 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Date | Gage height (ft) | Discharge ($ft^3/s$) | Date | Gage height (ft) | Discharge ($ft^3/s$) | Recurrence interval (years) |
| | | | | | KANAWHA RIVER BASIN--Continued | | | | | | | |
| 189 | Miscel-laneous site | Back Fork at Webster Springs, W. Va. | 69 | - | - | - | - | - | Nov. 4 | - | 7,700 | [k] >50 |
| 190 | 03194700 | Elk River below Webster Springs, W. Va. | 266 | [v] 1,020.1 | 1959-83, 1985 | 6/02/74<br>9/1861 | 13.97<br>26.34 | 23,900<br>- | Nov. 4 | [a] 17.2 | 38,000 | >100 |

a From floodmark.
b Significant regulation by reservoir(s) upstream.
c At site 95 feet downstream.
d At present site.
e At site 575 feet downstream at different datum.
f Affected by backwater.
g Altitude from topographic map.
h At previous site and datum.
i Datum of gage above National Geodetic Vertical Datum, adjustment of 1912.
j At previous site.
k Based on regional flood-frequency relationship.
m At site 1,100 feet downstream.
n At site 3,500 feet downstream.
p Estimated.
q At site and datum in use prior to August 17, 1944.
r Referred to present gage by curve of relationship.
s At site 17.5 miles upstream.
t From U.S. Army Corps of Engineers, Pittsburgh District, 1973.
u From floodmark at old Lock 4.
v Elevation from altimeters.